Chemical Engineering

A McGRAW-HILL PUBLICATION
ONE DOLLAR

JULY 1956

HOW TO
predict the amount
of catalyst you'll need
to get the right capacity
and conversion . . .

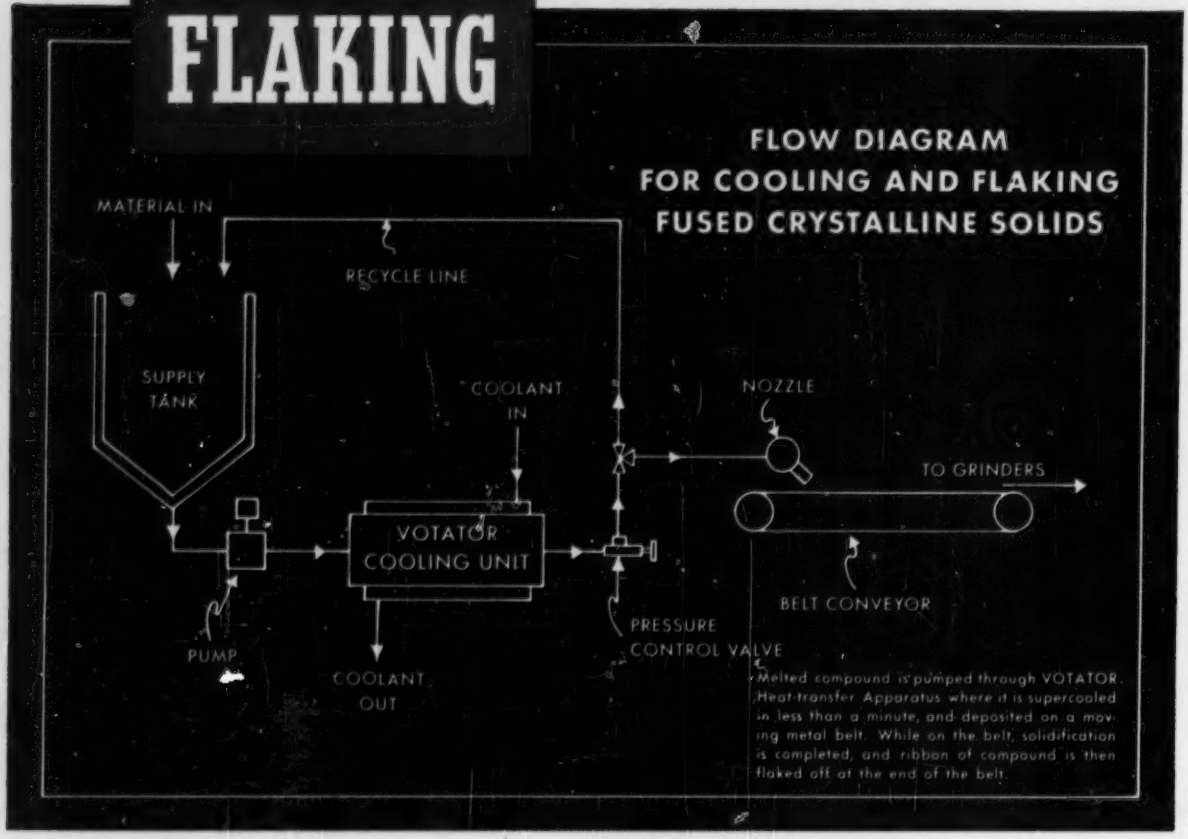
CATALYTIC REACTORS

PAGE 201

IDEAS

How to bypass those mental roadblocks (p. 218)

FLAKING


FLOW DIAGRAM
FOR COOLING AND FLAKING
FUSED CRYSTALLINE SOLIDS
MATERIAL IN
RECYCLE LINE
SUPPLY TANK
COOLANT IN
NOZZLE
TO GRINDERS
VOTATOR COOLING UNIT
BELT CONVEYOR
PUMP
PRESSURE CONTROL VALVE
COOLANT OUT
Melted compound is pumped through VOTATOR Heat-transfer Apparatus where it is supercooled in less than a minute, and deposited on a moving metal belt. While on the belt, solidification is completed, and ribbon of compound is then flaked off at the end of the belt.

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JULY 1956

JOHN R. CALLAHAM, Editor

GUIDED TOUR

A practical approach to the fundamental problem of reactor design

This month we're attacking a basic process design problem with you—catalytic reactors. After you follow the step-by-step procedure and illustrative examples you'll be able to predict catalyst needs as well as size and type of reactor for proper capacity and conversion. (p. 201)

Up-to-date look at energy sources

We've heard before that tremendous increases in energy consumption are making the supply critical. This month we project needs to see where and how large replacement sources will be. (p. 173)

Why not, indeed?

For solution to some of the problems of fluid flow there's the drag-coefficient

Please turn page

Another Mid-Summer Special

Today many processing plants spend more money and engineering effort on liquid-gas contacting than for any other operation. This is especially true in the chemical, petrochemical and petroleum refining industries.

What are these liquid-gas contacting operations? How are they related? Can they be linked to other chemical engineering operations? What equipment is now available for conducting them?

Can we reorient our engineering know-how to give us more profitable application of similar process equipment to the problems of contacting liquids and gases?

It is to answer such basic questions that we're publishing, in our next issue, a 32-page feature report on Liquid-Gas Contacting.

Here you'll find a practical evaluation of all the basic contacting operations—plus a comparative analysis of equipment from tray columns and packed units to jets and condensers.

Our author is Dr. Raymond E. Vener of the Catalytic Construction Co. You'll remember his two top-notch reports in 1955: Solids-Gas Contacting and Moving-Bed Processes.

Vener's report next month on Liquid-Gas Contacting will live up to—and perhaps excel—the high standards set by his two previous features.

We guarantee it'll start you thinking along lines that lead to savings in time, money and technical manpower.

Chemical Engineering

JULY 1956

GUIDED TOUR

approach. Why not borrow this concept that mechanical and aeronautical engineers have been using? (p. 177)

To organize for plant design

You can take a tip from the experts—the engineering contractors. Their organization for maximum effectiveness in design of process plants has a three-way potential value to you. (p. 185)

How much power for liquid mixing

From water to highly viscous pastes, here's a practical method for calculating the power necessary for mixing. You'll need only a minimum of information with this easy-to-use chart. (p. 195)

How's this for an idea?

Now you can recognize and avoid the three roadblocks to creative thinking. You'll not only be able to come up with ideas to solve your problems, but you can do it in a hurry. (p. 218)

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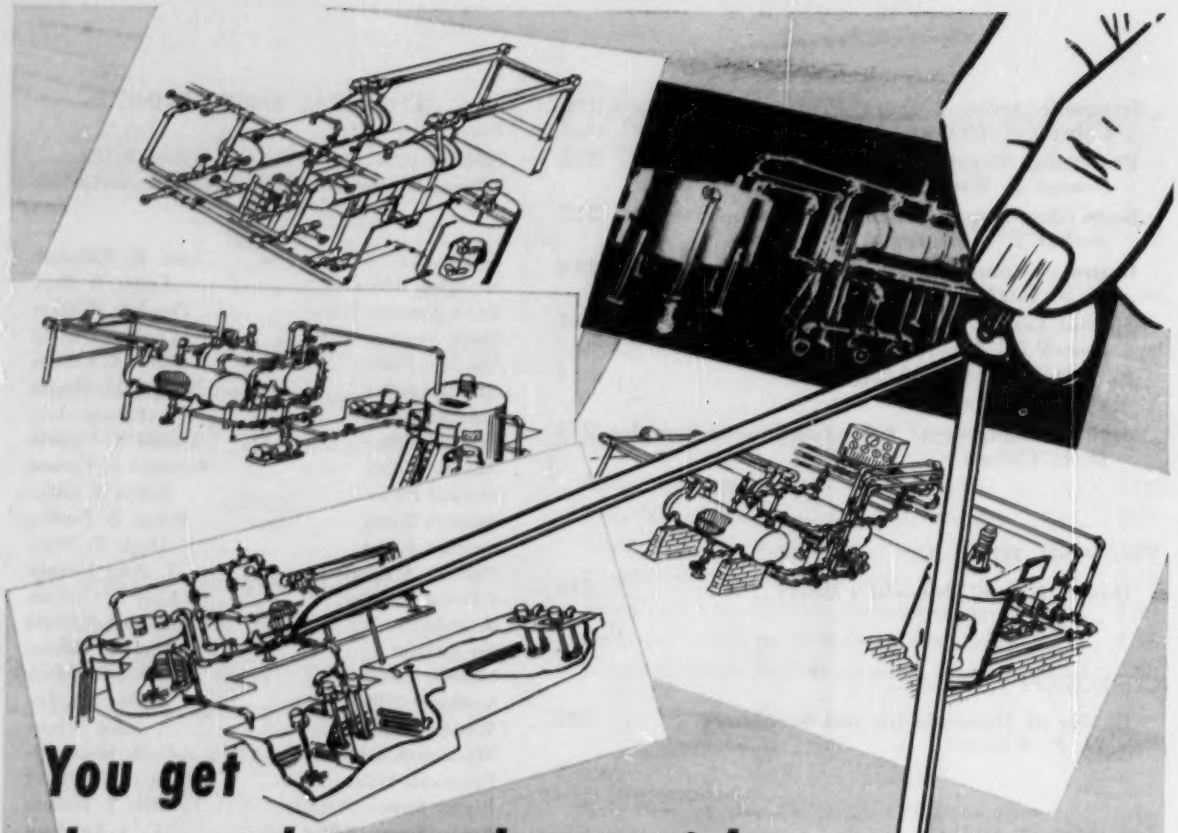

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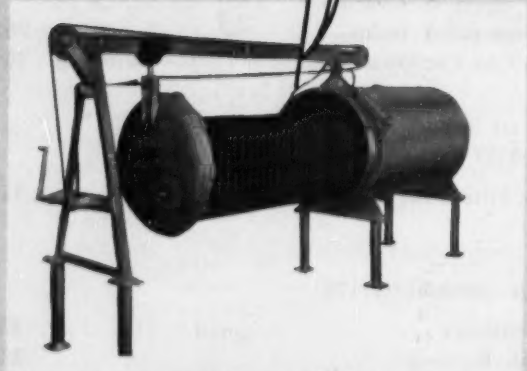
BIRD PRESSURE FILTERS

These filter stations are packaged units complete with pumps, piping, valves, fittings, meters, etc. — with every component carefully fitted to application requirements.

They are typical of the Pressure Filter installations Bird is prepared to design for you — a service which offers you the chance to acquire an efficient, economical filtration system delivered to your door.

Why not take advantage of this complete filtration service? Ask us to make recommendations and estimates.



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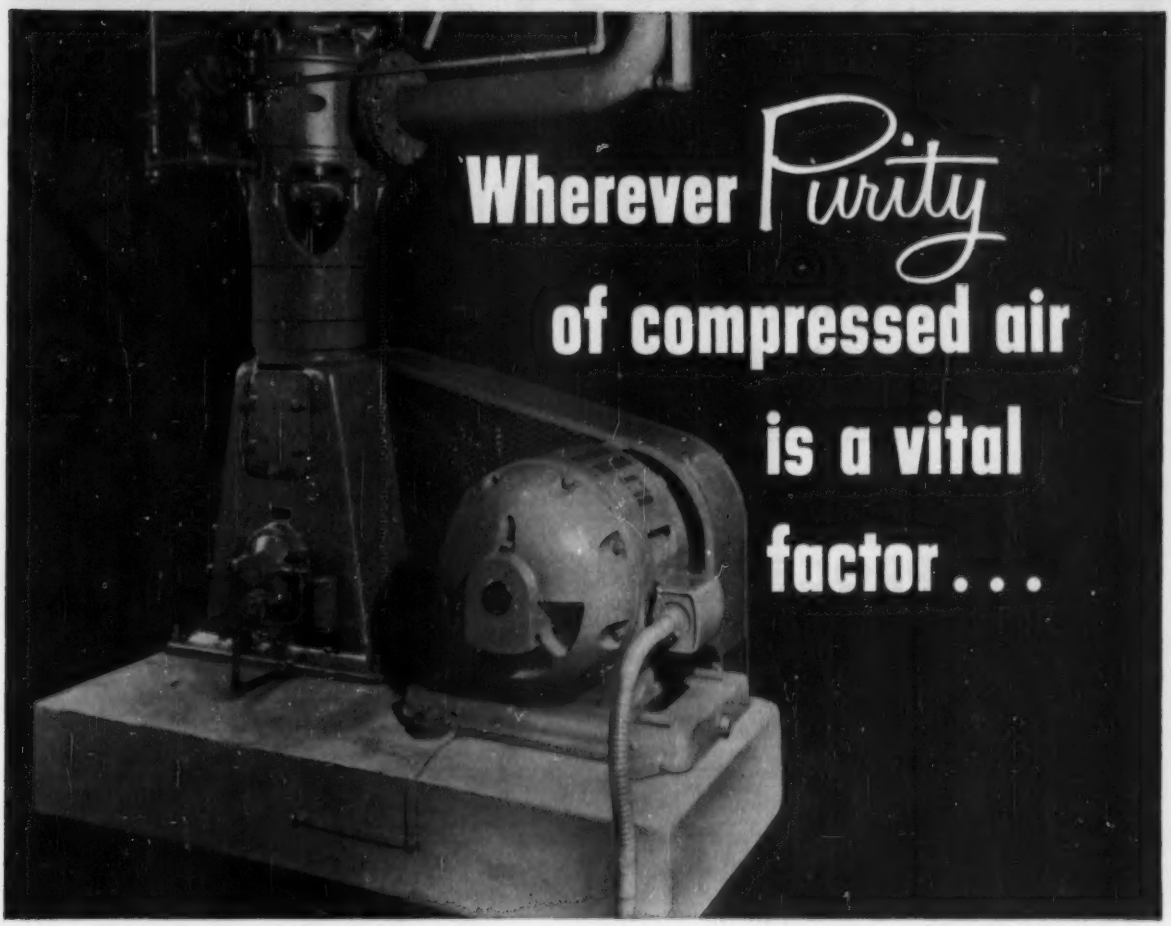

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Joy WG-9 oil-free compressors are equipped with carbon graphite piston rings. These need no lubrication, and compensate automatically for wear. Special lightweight pistons; large, direct air passages; and liberal water-jacketing reduce heat and minimize ring wear.

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The Joy WG-9 is a double-acting, water-cooled compressor designed for *continuous* service. It is full force-feed lubricated and features replaceable-on-the-job cylinder and crosshead liners. Capacity is to 881 CFM, 125 psi. This unit is available also as a lubricated machine for standard air needs or for vacuum pump service.

Joy builds regular and oil-free compressors to meet any capacity and pressure requirement. For complete details, write to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 57-11

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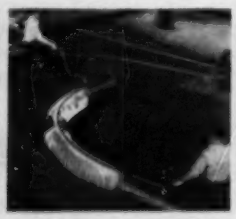
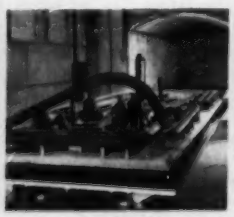
ATTENTION: *A 30-minute color sound film showing the quality and economy of Grinnell Shop Fabrication of all classes of piping is available for group showings.*

GRINNELL
WHENEVER PIPING IS INVOLVED

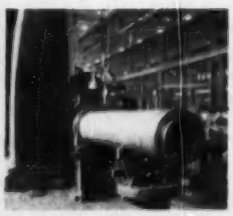
Pipe being heated to exact temperature required for proper bending



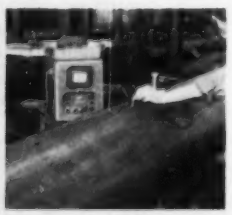
Skilled team completes bend in six minutes with pipe close to 2000°F



Fabricated piping, bending operation completed, enters stress-relieving furnace



Heavy wall pipe being machined to the proper welding bevel on a post mill



Ultrasonic testing of a weld on heavy wall pipe

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

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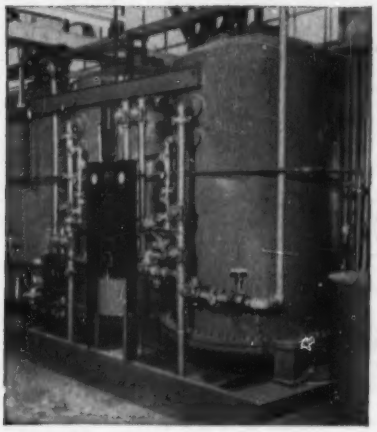

Easy-to-install Geon rigid vinyl pipe lasts longer

THE exceptional physical and chemical properties of pipe and fittings made from Geon rigid vinyl resins have cut costs in many systems and made entirely new applications possible. Here are the reasons:

1. **Resists oil, acids, alkalis, most chemicals.**
2. **Has high tensile and impact strength.**
3. **Resists sunlight, fungi, bacteria, moisture, heat and cold.**
4. **Smooth internal surface reduces flow resistance.**
5. **Rigid enough for overhead installation with pipe supports, but flexible enough to absorb shocks.**
6. **Easy to install. Lightweight (see photo), fittings attached by solvent cementing, threading, heat welding or adhesives.**
7. **Being a non-conductor, does not support electrolytic action.**

Applications include sour crude oil lines, salt water lines, chemical plant piping, industrial cold water lines, vent pipes for acid fumes and corrosive gases. Vinegar plants, ships at sea, oil fields —all are enjoying the rewards of cheaper and easier installation, lower material cost and longer pipe life under extreme conditions.

Send for new bulletin on Geon 8700-A—describes properties, applications, advantages of rigid unplasticized polyvinyl chloride compounds. Write Dept. DB-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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. . . made by specialists in corrosion-resistant metals

FLOWLINE fittings are engineered down to the last detail . . . and made, with almost watchmaker precision, by specialists in corrosion-resistant metals. The exclusive method used comprises a series of cold-working operations with intermittent anneals — a process which puts the metal in the best condition for corrosion resistance. The mechanical specifications of FLOWLINE fittings exceed requirements of applicable A.S.T.M., A.S.A., and M.S.S. codes — giving you plus values at no extra cost.

Make your corrosion piping light, tight, safe, strong. Butt weld straight-cut pipe to FLOWLINE fittings . . . tees, ells, reducers, stub ends, caps. Available from stock through leading distributors. Made in sizes ½" through 12" — Schedules 5S, 10S, 40S, 80S — Stainless Types 304, 304L, 316, 316L, 347, 348; Monel, Nickel, and Aluminum.

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the BIRD continuous centrifugal filter can handle almost any job

HOT	OR	COLD
Example: Brines at boiling temperature; glycerine, at 300°F.		Chemicals and hydrocarbons from zero to *minus* 100°F or lower.

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Example: Slurries at ball mill consistencies; thickener underflows.		Materials containing less than five percent suspended solids by weight; thickening not required.

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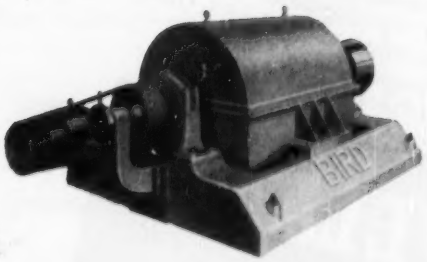
Example: Synthetic resins with a solids gravity of 1.1., liquids gravity of 1.05.		Barytes with a specific gravity of 4.3; mercury oxide at plus 11., and others.

LOW COST	OR	HIGH COST
Example: Coal, clay, fertilizers and other products selling for — dollars a ton.		Pharmaceuticals and fine chemicals selling for dollars a pound.

BIG	OR	SMALL
Example: Ton or more a minute.		A few hundred pounds an hour.



The range of successful, profitable application of the Bird Continuous Centrifugal Filter is so great that you owe it to your flow sheet to find out what it can do on *your* materials, under *your* specific operating conditions.

The Bird Research and Development Center is prepared to provide you with accurate, comprehensive pilot scale test data on which to base reliable performance and cost estimates in advance of your investment.

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- Bird Horizontal Tank, Vertical Leaf Pressure Filters
- Bird-Humboldt Screen Type Centrifugal Dryers
- Bird Suspended Centrifugals • Bird Centrifugal Classifiers
- Bird Continuous Centrifugal Coal Filters • Bird Polishers
- Bird Centrisweeps for delicate Crystals, Fibrous Materials

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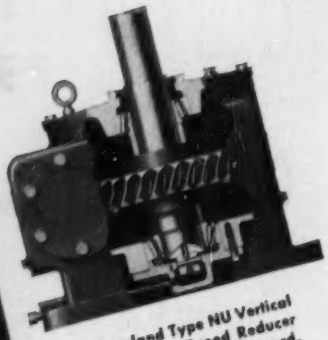


Cleveland Type NU Vertical Worm Gear Speed Reducer with drive shaft upward. Cutaway shows heavy gear shaft, rugged shaft bearing mounting and extra sturdy housing construction.

Versatile, fast acting filter has NU drive

CLEVELAND Type NU Worm Gear Drive transmits smooth, uniform speed to permit efficient operation for this Filtration Engineers' Horizontal Rotary Vacuum Filter. For coarse crystalline materials, fibrous pulps and other free-settling substances, it offers high capacity, fast dewatering and excellent cake washing.

It was important that this filter be compact. Right angle construction of the Cleveland Worm Gear saves space. Efficient performance is inherent. There's smooth, uninterrupted torque flow and quiet running. Case hardened steel worm and nickel-bronze gear actually improve with use—will be even more efficient years from now.

Get the complete Cleveland story before you install your next speed reducer; see how much Clevelands can do for you. Write for Catalog 400. The Cleveland Worm and Gear Company, 3275 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

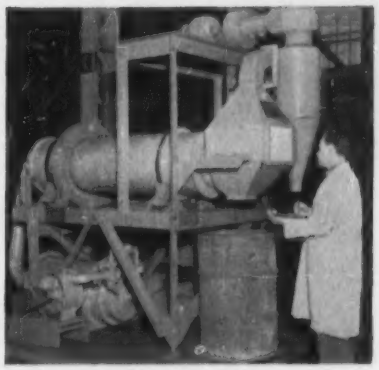
CLEVELAND
Worm Gear
Drives

PRE-PROVE

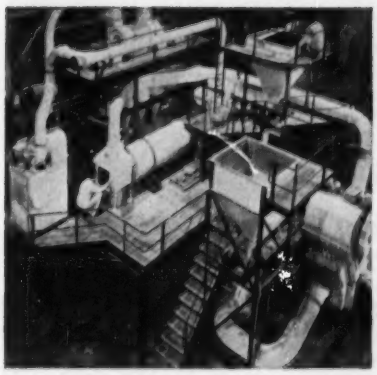
your drying, cooling or roasting process

Utilize LINK-BELT test facilities for no-cost analysis of your product

1. BEFORE YOU BUY A DRYER, here's an exact, obligation-free way to determine the best processing procedures for your requirements. Send a sample of your material—a pound or a ton—to Link-Belt.

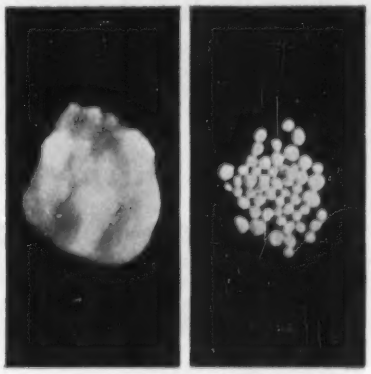


2. FOR SMALL BATCHES . . . miniature, reduced-scale equipment is used to pilot-run your sample. Link-Belt has made over 1000 of these and full-scale tests, successfully processing more than 100 materials.

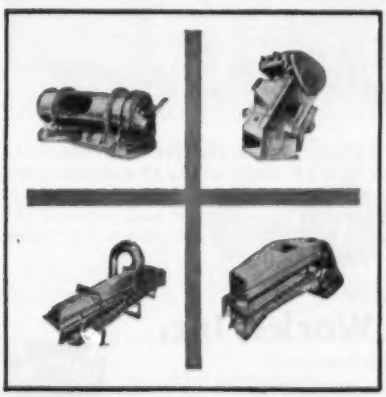


3. LARGE RUNS are tested on standard production equipment. Where sending samples is impractical, we will put a unit on loan in your plant and counsel on efficient, systematic testing procedures.

4. AGENTS must sometimes be added before a material can be dried, cooled or roasted. That's why an analytical laboratory supplements Link-Belt's miniature and full-scale processing facilities.



5. RESULTS of these tests show how you can economically change the size, shape or consistency of materials . . . blend, compound or alter chemical compositions. Sludge (left) was converted to pellets.



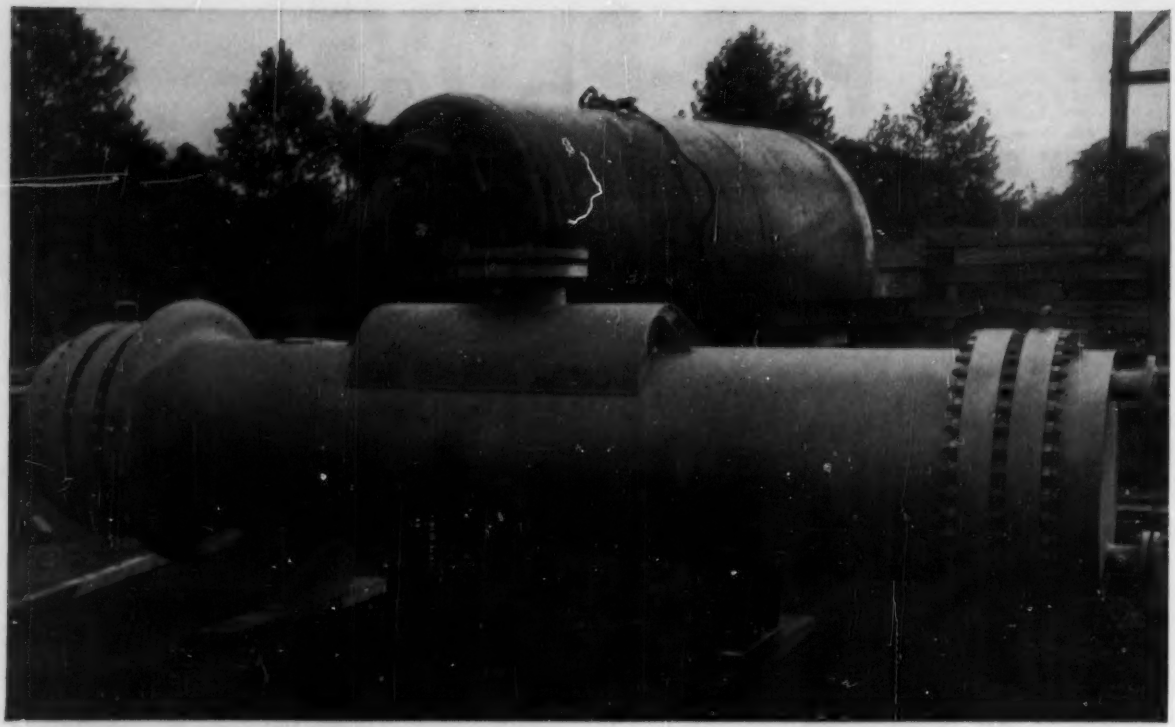
6. FINALLY our engineers will show how these procedures can be duplicated in your plant . . . will recommend the right dryer from Link-Belt's broad line that includes Roto-Louvre, Multi-Louvre, Oscillouvre and Monotube.

For more information, call your nearest Link-Belt office or plant today for consultation with a dryer specialist. Or send your sample to LINK-BELT COMPANY, Dryer Laboratory, 300 West Pershing Road, Chicago 9, Illinois.

LINK-BELT

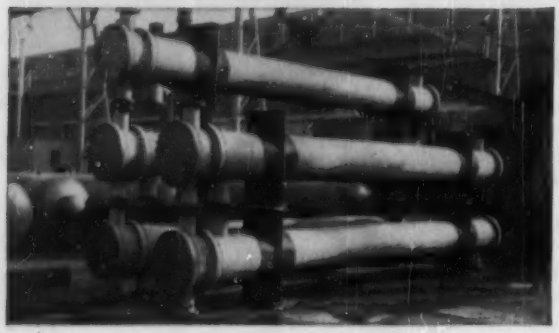
DRYERS • COOLERS • ROASTERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 14.580

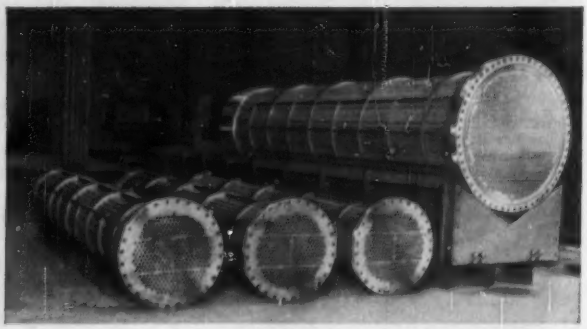


Inconel and stainless heat exchanger built for Barrett Division, Allied Chemical & Dye Corporation. Shell Diameter: 30". Tube Length: 12' 0". Tubes: 1" O.D. x 14 ga. Tube Sheet Thickness: 2". Materials: Inconel shell, tubes, tube sheets. Stainless steel heads, Type 316L.

Stainless steel plus nickel alloy equals corrosion-resistant heat exchanger by Downingtown



Aluminum bronze for these five coolers saved the customer 25% on equipment costs, assured corrosion resistance. Each fixed tube sheet unit is 20" in diameter x 20' tube length. Each has 282 aluminum bronze tubes ¾" O.D. x 12 ga. Centrifugally cast channels. Design pressure: 150 p.s.i. on both shell and tube sides.



Stainless steel Type 304 is the material for these four tube bundles. The large one fits a 37" shell, has 1225 stainless tubes, ¾" O.D. x 14'0" long. Tube sheet: 2⅞" thick. Baffles: ⅛" thick. The other three bundles are 22" in diameter; each contains 352 tubes ¾" O.D. x 16 ga. x 12'0" long. Tube sheets: 1¾" thick. Baffles: ¼" thick. All stainless steel.

Corrosion-resistant materials a heat exchanger specialty at Downingtown

We have the engineering, welding and fabricating experience to turn out your corrosion-resistant exchangers in the materials you specify: stainless, nickel, nickel alloy, aluminum bronze, carbon and many others. Our design recommendations often save money. Send for Bulletin HE. Your engineers will find it useful.

Downingtown Iron Works, Inc.

HEAT EXCHANGERS—STEEL AND ALLOY PLATE FABRICATION

140 Wallace Ave., Downingtown, Pennsylvania—Branch Offices:

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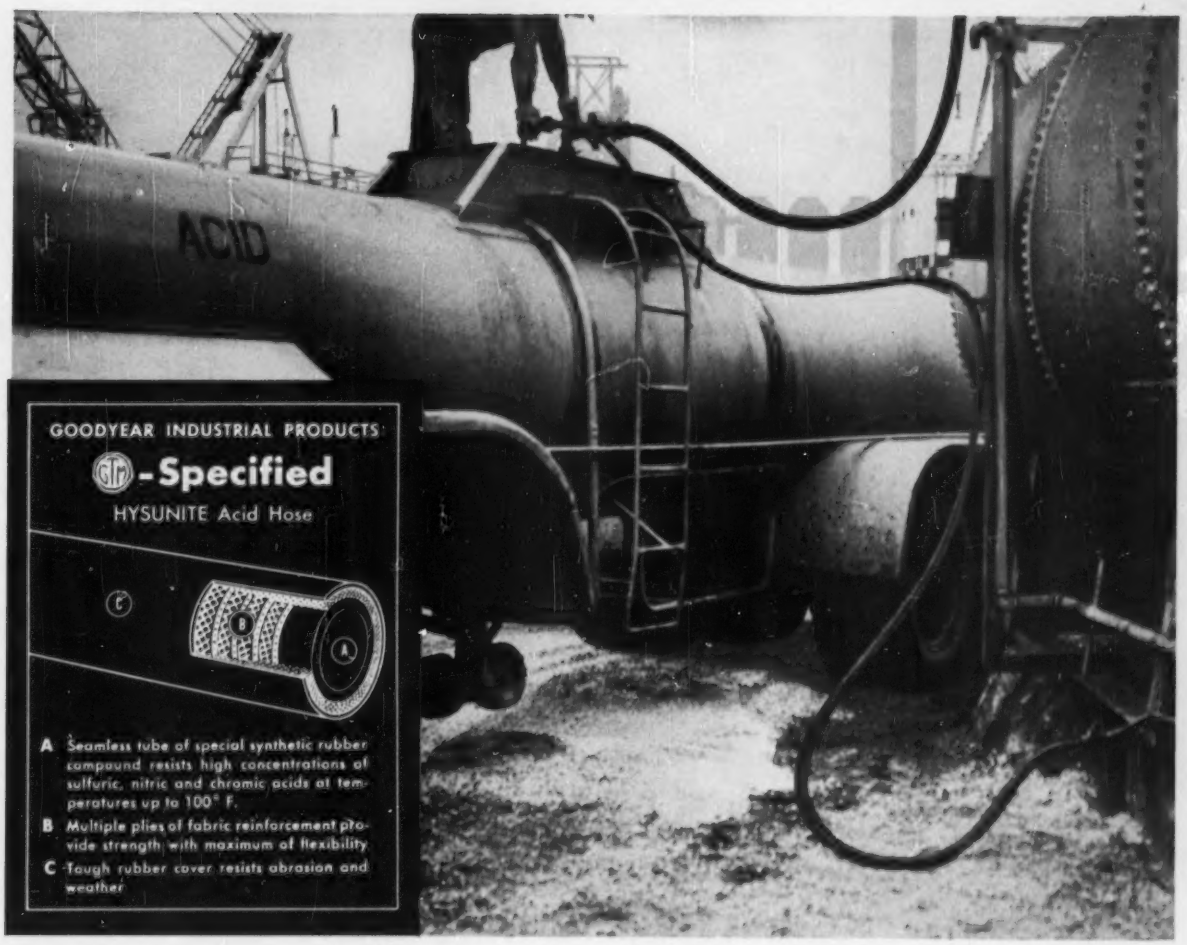
DOWNINGTOWN IRON WORKS — Hackney

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS


ACID
GOODYEAR INDUSTRIAL PRODUCTS
G.T.M.-Specified
HYSUNITE Acid Hose
C
B
A
A Seamless tube of special synthetic rubber compound resists high concentrations of sulfuric, nitric and chromic acids at temperatures up to 100° F.
B Multiple plies of fabric reinforcement provide strength with maximum of flexibility.
C Tough rubber cover resists abrasion and weather.

G.T.M. increases acid hose life by 900%

ACID–66° Baume Sulfuric–was the problem at this eastern steel mill. Many types of hose were tried for its transfer from truck to storage tank. But the best hose delivered *only 2,500,000 lbs.* of acid, before embrittling and breaking.

Then the G.T.M.–Goodyear Technical Man–recommended his new HYSUNITE Hose, specifically developed to handle highly oxidizing acids in high concentrations at temperatures up to 100° F. This rugged hose handled a fabulous *26,500,000 lbs.* of acid–was good for many more pounds – when it was removed from service for thorough checking.

If you have hose problems, it will pay you to consult your Goodyear Distributor and/or the G.T.M. Or write Goodyear, Industrial Products Division, Akron 16, Ohio.

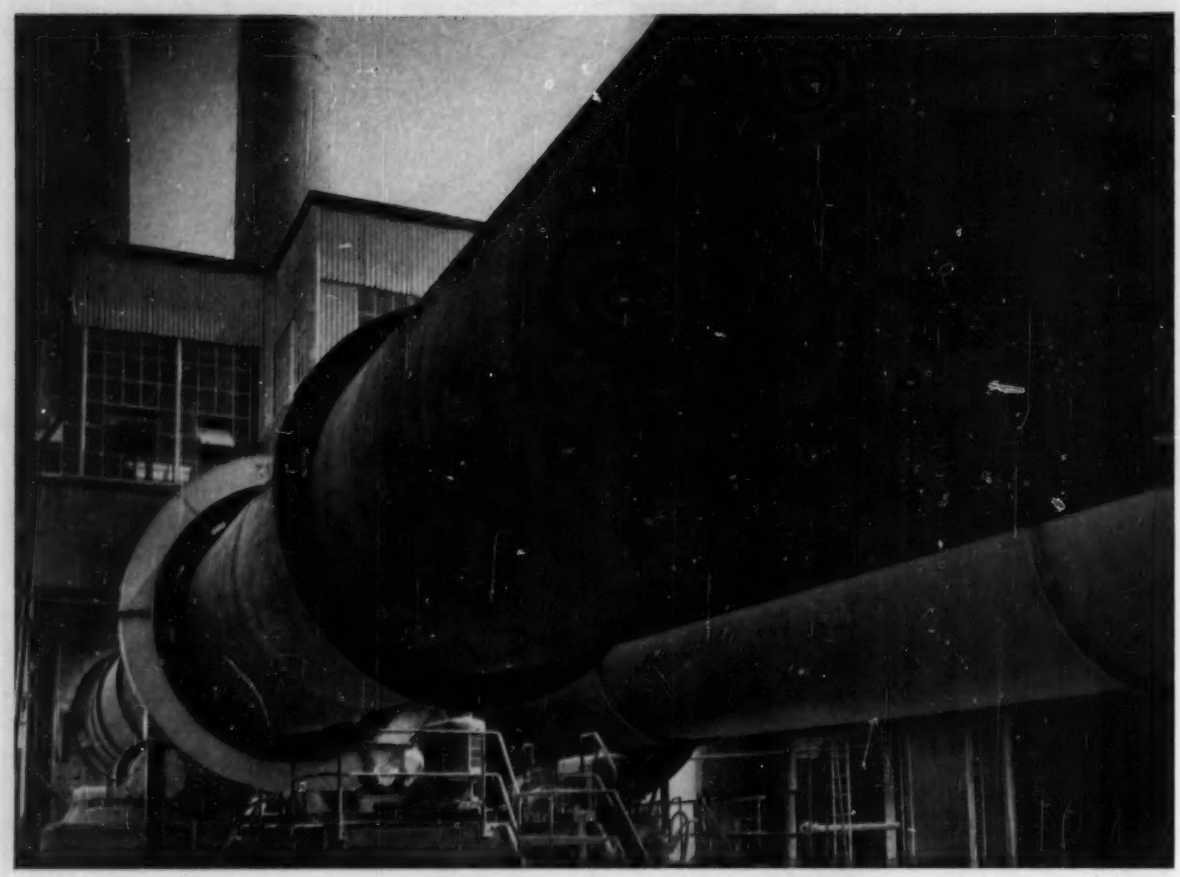
HYSUNITE HOSE by

Hysunite–T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

THE GREATEST NAME IN RUBBER

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*



A TRAYLOR ROTARY KILN

Almost 10½ miles long

That's what it would take to equal the combined length of all the rotary kilns Traylor has built in the last 14 years. Built on the average of over 1 a month, more than 175 Traylor Rotary Kilns are currently engaged in the calcining, roasting and chloridizing, volatilizing, sintering and nodulizing of over 20 different products. Many of these are operating in the limestone and cement producing industries.

With this wealth of experience, Traylor has become thoroughly familiar with the thermo-processing requirements of modern limestone and cement production. Traylor has developed many advance rotary kiln design features that contribute to the low cost, trouble free calcining of lime and cement.

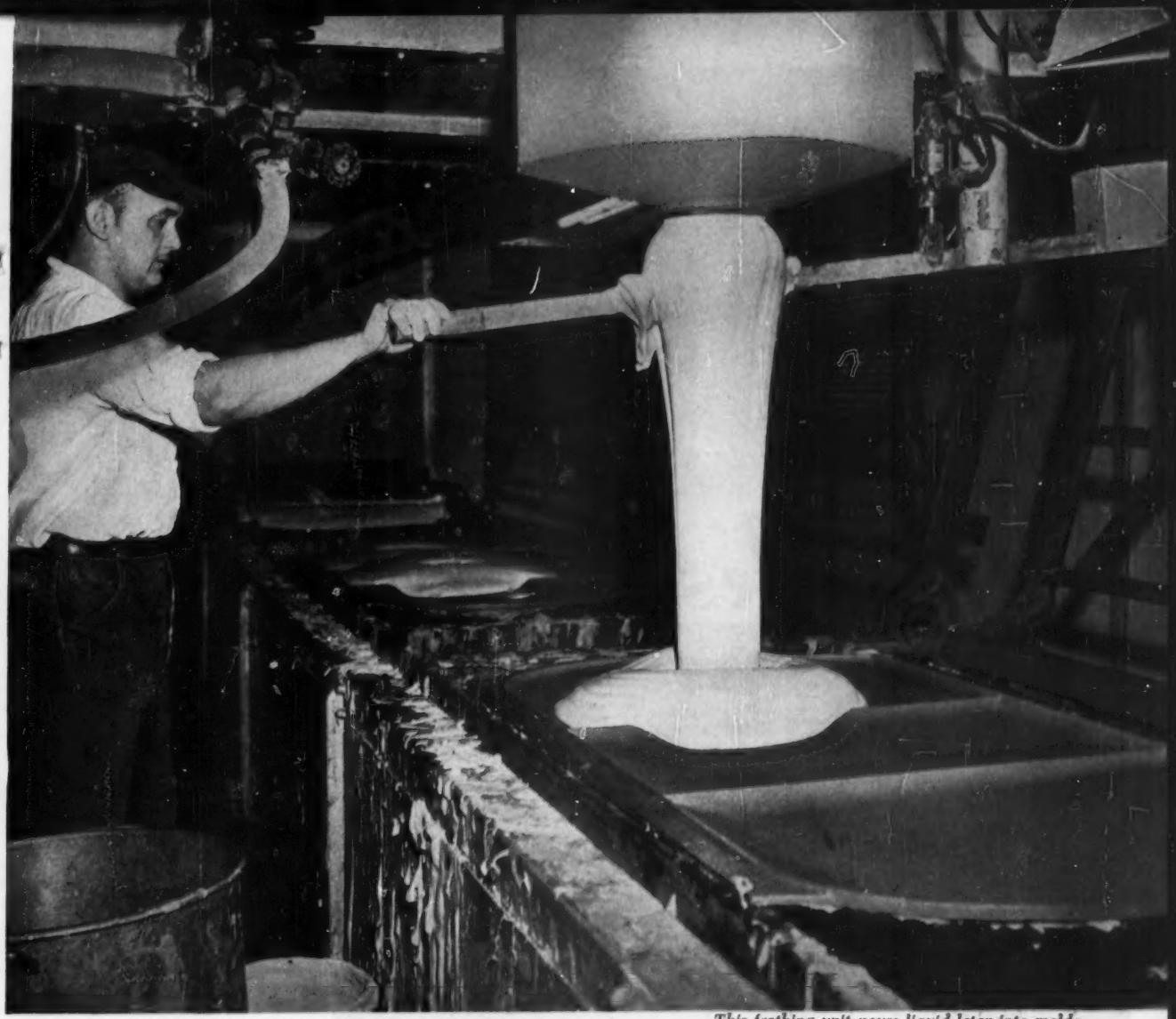
Every Traylor Rotary Kiln is individually "Traylor-Made" for its specific job. Sizes have been built from the smallest up to 12′ in diameter and 450′ in length.

Bulletin #1115 will give you all the facts and information on the profit-producing advantages of Traylor Rotary Kilns. Write for your free copy today.

TRAYLOR ENGINEERING & MFG. CO.
839 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco
CANADIAN MFR: Canadian Vickers, Ltd., Montreal, P. Q.

Traylor **ROTARY KILNS**



This frothing unit pours liquid latex into molds.

Demineralized water helps GOODYEAR* maintain Airfoam* quality—and saves money, too!

The minerals dissolved in raw water carry electrolytic charges. If such water is used for latex dispersions, the rubber coagulates prematurely . . . causing excessive waste.

Goodyear tried distilled water . . . until increased production overtaxed the steam plant.

So Goodyear engineers looked into ion exchange. After evaluating various demineralizers, they selected Permutit resins and equipment.

Here's what they report after 4 years of continuous operation: "The Permutit units reduce dissolved solids from 165 to 3 ppm and supply iron-free water of controlled alkalinity. It has proved to be *higher in quality* than distilled water—at a considerable saving!"

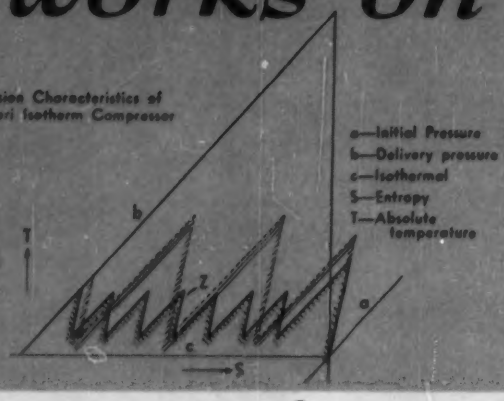
Better water may solve your problem. Write to learn what Permutit can do to help you. The Permutit Company, Dept. CE-7, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., 207 Queen's Quay, Toronto 1, Ont.

**T.M.'s The Goodyear Tire & Rubber Company*

WATER CONDITIONING
ION EXCHANGE
INDUSTRIAL WASTE TREATMENT

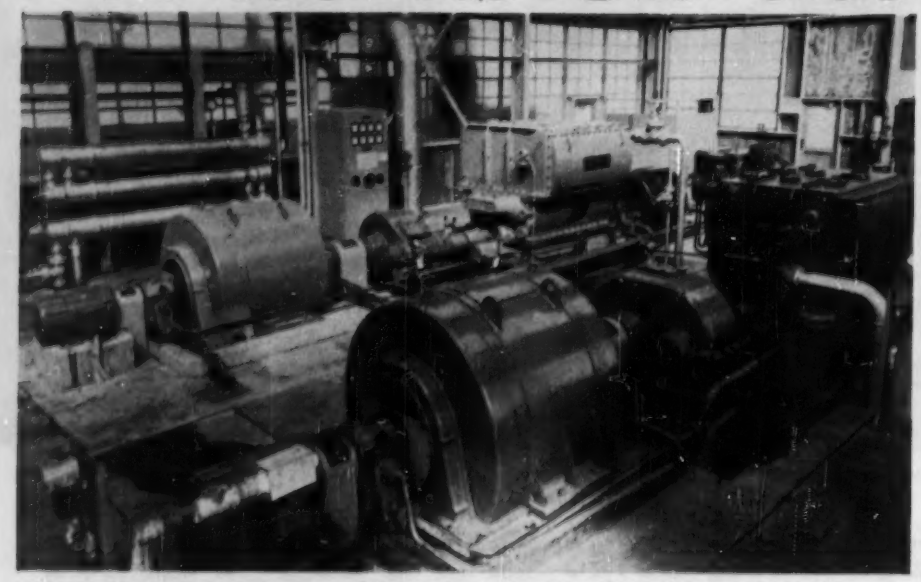
PERMUTIT

it works on paper...



THE Brown Boveri Isotherm Compressor compresses the air along the solid line (Z) in nine stages with seven intermediate coolers. This arrangement justifies the name of "Isotherm" because compression approaches the ideal isothermal line. The broken line indicates the compression characteristic when only three intermediate coolers are used. The difference between the areas below the compression lines is a measure of the difference in required power input.

it works on the job...



THE 7,125 SCFM Brown Boveri Isotherm Compresser (shown in the foreground) used for Liquid Air Processing and the 12,000 SCFM Brown Boveri Isotherm Compressor (background) used in nitric acid production in the new ammonia and fertilizer nitrogen solution plant of U. S. Industrial Chemicals Co., Division of National Distillers Products Corporation, at Tuscola, Illinois. The nitric acid unit was designed and constructed by Chemical and Industrial Corporation.

BROWN BOVERI

A BROWN BOVERI Isotherm Compressor unit makes possible major economies in any kind of chemical processing where large volumes of air at modest pressures is required.

Each unit is completely integrated equipment consisting of the inter-stage cooled isotherm compressor, a reaction-type highly efficient expander and a synchronous motor . . . all designed, manufactured and tested by Brown Boveri to operate as a "package" unit. Its design embodies more than a quarter century's experience in producing large air volume compressors for a wide variety of purposes *plus* a world-wide reputation for leadership in gas turbines and electrical power generating and distribution equipment.

Users of Brown Boveri Isotherm Compressors are assured of *greater efficiencies, substantial dollar savings in operational costs, longer life, dependable and trouble-free operation* and *far less maintenance* than with any comparable equipment on the market today!

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

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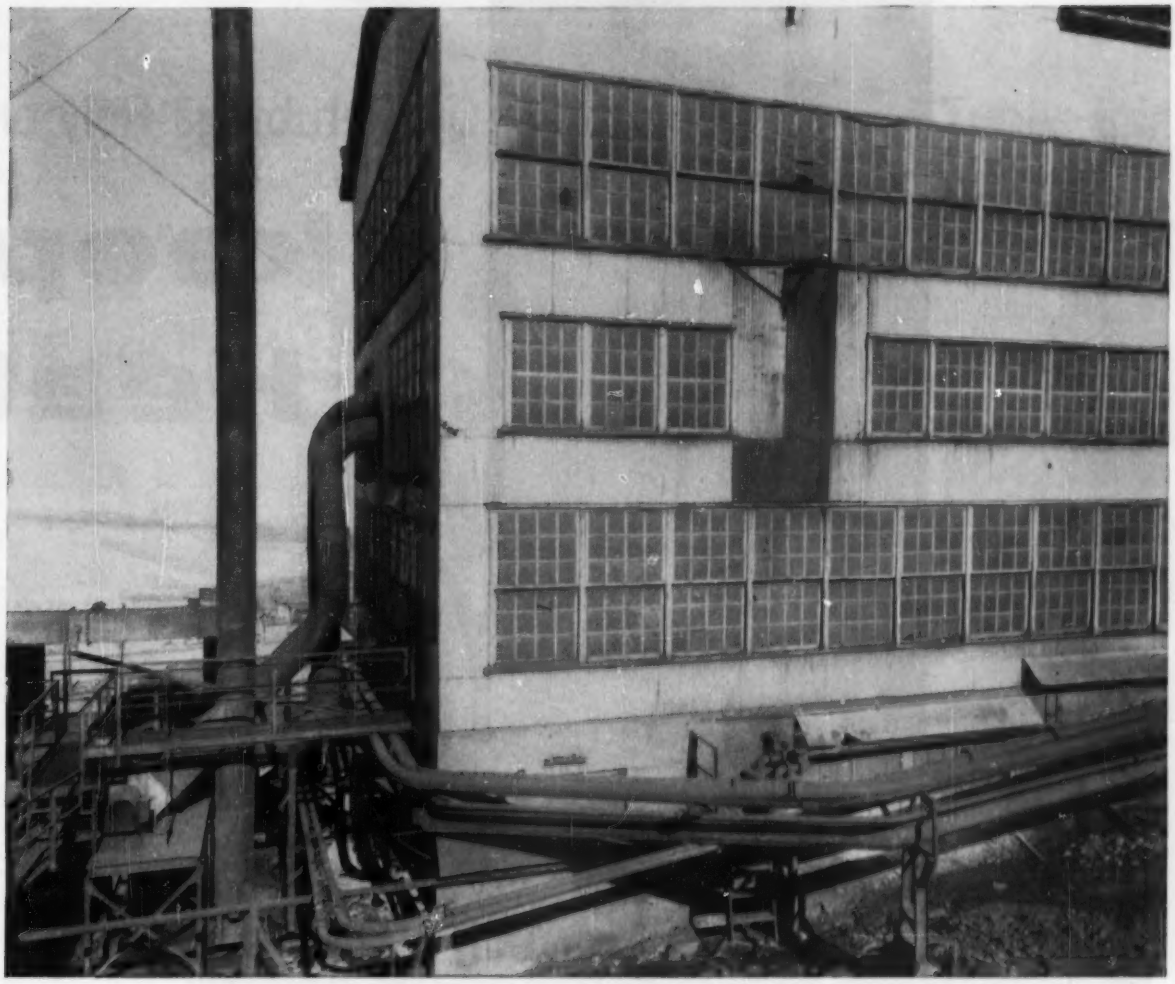
B.F.Goodrich



Rubber artery with a pounding pulse

A typical example of B. F. Goodrich improvement in rubber

SHOOTING through that long pipeline is hot, roasted molybdenum on its way to cooling tanks. It used to travel through iron pipes. But the lime in the mixture would stick to the metal, build up thick deposits, slow down the flow to a trickle. The plugged pipe had to be replaced at least once a year, sometimes more often.

When a B. F. Goodrich man heard of the problem, he suggested that rubber hose take the place of the troublesome pipe. He had in mind a B. F. Goodrich hose, made with a special rubber lining that resists acids and a tough rubber-and-fabric body to stand the pumping pressure. What's more, he knew this B. F. Goodrich hose would be flexible enough to expand and contract with the pump pressure, like a pulse beat in an artery, and so break off lime deposits as fast as they would form.

This B. F. Goodrich hose was tried, and worked perfectly. No reduction in flow whatsoever. In use almost continuously 24-hours-a-day, 7 days a week, the hose has outlasted pipe *10 to 1*. There are even some lengths on this job after 15 years service!

Improvements are constantly being made in all kinds of B. F. Goodrich hose to make them last longer, stand more abuse, handle easier, and cost less. Your B. F. Goodrich distributor is an expert at solving hose problems. Call him when you need help, or write *B. F. Goodrich Industrial Products Co., Dept. M-672, Akron 18, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS

Retubing? Rely on

keep Heat

First for Lasting Quality—from Mine to Market!

Phelps Dodge COPPER-BASE ALLOY Tubes to

your Exchangers On-Stream!

- ✓ **Complete line of copper-base alloys** including Bi-Metal combinations to meet special corrosive conditions.
- ✓ **Speedy delivery** from strategically-located warehouses.
- ✓ **Careful analysis of your corrosion problems** by experienced engineering staff.
- ✓ **Quality-controlled fabrication** to assure finest tube properties.
- ✓ **Information and sales service** available from nearest Phelps Dodge district office.*

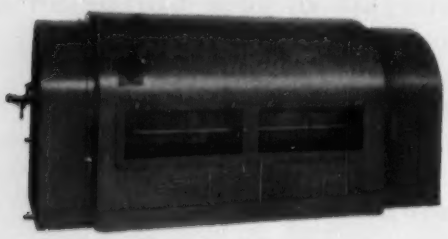
PHELPS DODGE COPPER PRODUCTS CORPORATION

PHELPS DODGE COPPER PRODUCTS CORPORATION

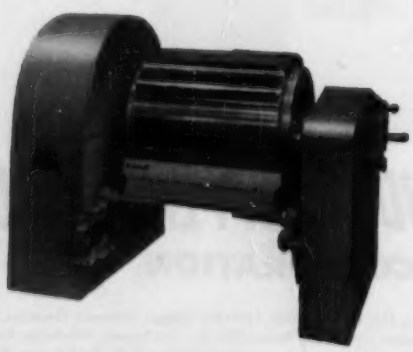
*SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle Washington, D. C.

"Special" features are standard in

A Stokes flaker used by Tennessee Eastman Company in the production of Tenamene 3 inhibitor.



Around-the-clock operation of this Stokes flaker produces 35 tons daily of an organic resin. Total enclosing of 2½ ft. by 6 ft. unit eliminates dust and fume hazard.



600 pounds per hour of a petroleum-base wax with a melting point of 180F is flaked on this 24" by 24" Stokes machine.

Uranium slurry is processed at a rate of 250 pounds of dried material per hour . . . with this Stokes totally enclosed, 24" by 24", single drum dryer.

that assure economy

Stokes drum dryers and flakers

STOKES drum dryers and flakers are engineered to be as modern as the new products that you'll process with them. They are precision machines, designed by specialists in chemical processing equipment. Standard features built into them, usually considered "special" in this type of equipment, make them exceptionally economical to operate . . . high in production efficiency, low in maintenance.

Count on Stokes for these design "extras"—

Rigid doctor blade arrangement.

End scrapers—provided as standard equipment.

Anti-friction roller bearings.

Lateral roll adjustment—to assure edge alignment.

Totally enclosed end frames—to protect bearings and power drive.

Six-point, edge pressured end board adjustment—to prevent plate deflection and leakage.

Amply powered, compact variable speed drive—to provide high torque.

Stable, balanced drums—to hold tolerance and shape at high or low steam pressures.

For information and specifications, write to Stokes today . . . or contact your nearest Stokes office. Call on the Stokes Advisory Service, too, for valuable help, not only in applying drum dryers and flakers, but also in correlating the operation of this equipment with other processes in your plant.

Bring your production problems to the Stokes Laboratory

For many years, Stokes has maintained a complete laboratory service for its customers. Fully equipped with both pilot and production-size equipment, this laboratory can help you to apply to your own problems the knowledge gained during more than half a century of experience. From it come recommendations for processing techniques, most effective size and type of equipment, special designs or modifications . . . to assure that you realize the full potential of the Stokes equipment that you use. Call your local Stokes office for a discussion of the problems you'd like the Stokes Laboratory to investigate.

Process Equipment Division
F. J. STOKES CORPORATION
5512 Tabor Road, Philadelphia 20, Pa.

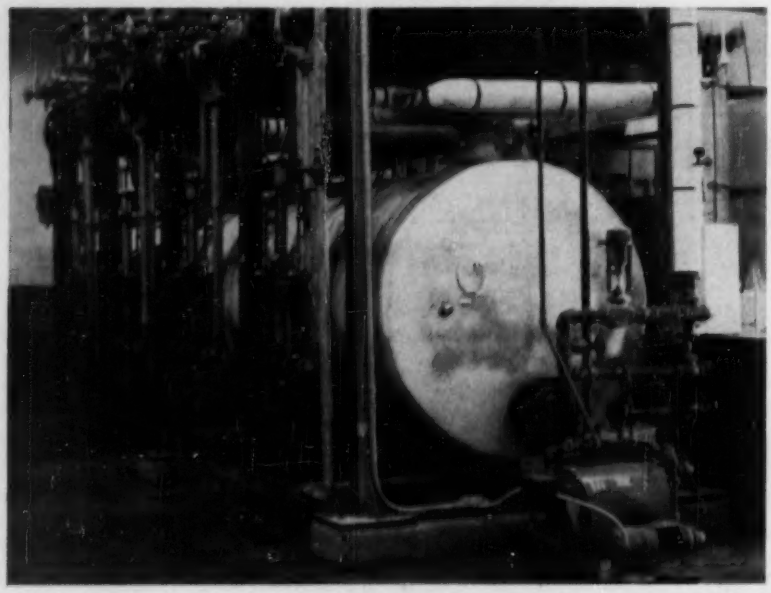
STOKES

EXTRA FAST DELIVERY
of standard Pfaudler glassed reactors now!
SEE BACK COVER THIS ISSUE.

Pfaudler

Pfaudler Corrosioneering News Published by The Pfaudler Co., Rochester, N.Y.

How Sylvania heats, cools four separate solutions to ±1° accuracy . . . in one system



The problem at Sylvania Electric Products, Inc. was to find a system that would hold four different solutions to within 1° F. of a predetermined temperature. These solutions, which are used in the television tube screening and lacquering processes, may be required for use between 55° and 70° at any time, and are supplied to the system at anywhere from 38° to 78° F.

Thus, the system must either heat the solution or cool it. It must also vary the degree of heating or cooling. And it must switch from heating to cooling, depending upon the change of set point.

Now in operation at Sylvania's Seneca Falls, N. Y. plant is the Pfaudler system shown above. It does all the thermal gymnastics mentioned, and still holds to within 1° accuracy on all four solutions.

This system, completely designed and equipped by Pfaudler, includes heat exchangers, all control valves, the heating equipment, refrigeration equipment, automatic controls, panel board and all auxiliary equipment. It is typical of the type of project engineering Pfaudler now offers. Let us give you the complete story on this added Pfaudler service.

New "hardware" for glassed vessels

Spray valve eliminates manual cleaning of vessel . . . high-pressure valve takes up to 300 psi . . . "Christmas Tree" inlet mixes 5 liquids at once . . . outlets and line valves work by remote control.

To minimize build-up of PVC resins or similar products in a glassed steel vessel, Pfaudler offers a new glassed spray valve (Fig. 1). The liquid spray from this valve covers the entire interior surface of the kettle. Its spray has sufficient intensity and coverage to perform a good job in any size vessel up to 120" diameter. The major part of the liquid stream is directed upward toward the dome while a smaller portion is aimed 30° downward toward the agitator and baffle. When the stem with spreader is rotated, the spray pattern turns, thus covering all surfaces with a direct spray.

New valve for high pressures

With the corrosion resistance of glassed steel inside, and the brute strength of cast iron outside, the new Pfaudler high-pressure valves take up to 300 psi, handle corrosive products ranging up to pH12 and 212° F. (Resists *all* acids except hydrofluoric, of course.) A big help here is also the fact that sticky products—even polymers—rarely ever stick to glass, so you get smoother flow through the valve.

Fig. 1 New Pfaudler glassed spray valve speeds cleaning of glassed reactors.

The new "Christmas Tree" sight box and multiple inlet assembly (Fig. 2) now offered by Pfaudler has four openings above and one inlet beside the sight box. The box itself (available in four sizes) has a sight glass on front and back, so you get plenty of light to see through the 4" to 7½" clear PYREX brand glass. With the five openings, you can admit from one to five different liquids at once into the vessel.

Fig. 2 New Pfaudler multiple inlet assembly with sight box.

Nobody scrambles around underneath reactors, when you have the new remote control features now available on Pfaudler valves. For both outlet and line valves, three distinct types of remote control are possible: (1) air-pressure or spring-pressure closing, (2) chain operation of both the operating and wiping wheels, (3) flexible shaft operation of valves. All of which save you labor, possible hazard of accidents, and time.

Corrosioneering News

Quick facts about services and equipment available to help you reduce corrosion and processing costs.

Get continuous centrifuging in your continuous processes

For *continuous removal* of solids from one or two liquids . . .

For *continuous concentration* of solids by removal of liquid from slurries . . . and discharge of solids in a predetermined dry state . . .

It is no longer necessary for your centrifuging to be an expensive and time-consuming "batch" type operation.

While rotating at full speed, the Titan Superjector Centrifuge discharges solids deposited within the centrifugal bowl and thus cleans itself.

How it works

A simple yet unique design enables the Superjector to work automatically like no other centrifuge.

Solids are discharged through peripherally placed slots. These slots periodically are opened and closed by a telescopic action actuated by hydrostatic pressure. This pressure is built up by centrifugal force.

The concentration of solids and clarity of liquid produced can be adjusted within wide ranges. Solids can easily be concentrated to as low as 40% moisture content. Liquids can be rendered crystal clear.

If you can see uses for such an automatic centrifuge in your operations, write for your free copy of Bulletin No. 930, "Titan Superjector Centrifuge." Or ask your Pfaudler representative for details.

Now—fastest drying of corrosive products with Pfaudler dryer-blender

How do you go about drying highly corrosive products in your plant?

If you're not using a Pfaudler conical glassed steel dryer-blender you may be spending too much time and money on this process.

4-day drying yield ready in 7 hours... reported one user making product containing acid halides. Filling and emptying the Pfaudler conical glassed steel dryer-blender is quick and easy. It has a 1½ foot diameter opening for filling and a single 8 inch discharge nozzle for the 4 ft. and 6 ft. units.

At Eastman Kodak Company this Pfaudler dryer-blender, used for drying a corrosive organic halide, has reduced time required by previous methods (4-6 days) by 75%.

Most of the labor cost and time previously spent handling trays of vacuum dryers is saved.

When in use, the dryer slowly revolves, tumbling its contents and quickly providing an evenly blended, evenly dried product.

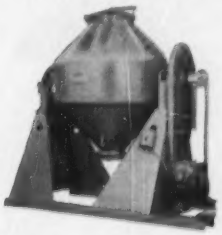
Why Pfaudler dryer-blender is fastest These structural features built into the Pfaudler glassed steel conical dryer-blender make it your fastest and most economical tool for drying and blending highly corrosive products:

- Solid one-piece construction of inner vessel for maximum strength, greatest corrosion resistance and easiest cleaning.
- Right amount of space between inner vessel and spherical portions of jacket heads insures effective drying with no waste of steam or hot water.
- No joints or clamps to break up the drying surface area. This heated surface area is maximum; therefore drying time is shortest.
- Vacuum exhaust tube is located up and out of the product while the unit is in operation. There it is able to remove vapors most efficiently.

Dries acids and alkalies

You can use Pfaudler conical dryer-blenders for every acid except hydrofluoric and for alkalies up to pH12 at 212° F. Thus you get the same flexibility you are already familiar with in Pfaudler glassed steel reactors, heat exchangers, columns and other equipment for tough corrosion jobs.

These dryers range in volume up to 165 cu. ft. working capacity. They are available in four different diameters: 2 ft., 4 ft., 6 ft., and 8 ft. Internal pressures may range from full vacuum. Each unit is tested to meet ASME code specifications.



It's easy to get complete details. Just write for Data Sheet 26 or contact your Pfaudler representative.

Designers and fabricators of glassed steel and alloy equipment for the chemical processing industry. Factories in: Rochester, N. Y.; Elyria, Ohio; Leven, Fife, Scotland; Schwetzingen-Baden, Germany; Kobe, Japan. Sales offices in principal cities of world.

THE PFAUDLER CO., Dept. CE-7, Rochester 3, N. Y.

Please send me:

- ☐ Bulletin 511 —"Pfaudler Services."
- ☐ Bulletin 886 —"Pfaudler Pipe, Valves and Hardware."
- ☐ Bulletin 930 —"Titan Superjector Centrifuge."
- ☐ Pfaudler Data Sheet 26 — Dryer-blenders.

Name_____

Title_____

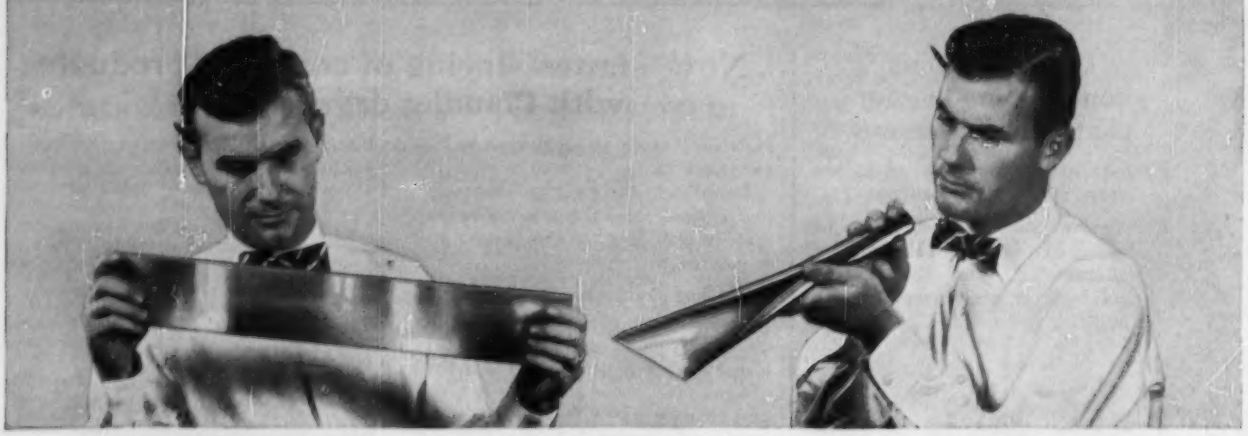
Company_____

Address_____

City_____ Zone_____ State_____

INSIDE INSPECTION—Here's where the safeguarding of quality begins in Republic Heat Exchanger Tubes. Painstaking care at Republic's flat-rolled mills and Steel and Tubes Division pays off in dependable service later on. Starting with the top of the trimmed, flat-rolled steel (which becomes the inside of the finished tube), all steel surface is checked closely for defects.

FORMING—The high quality, flat-rolled steel is now fed into the forming rolls. The tubular shape is developed by passing the steel through a series of rolls which progressively changes it into a butted tube. The highly polished rolls accurately control uniform roundness in every foot of tubing.



Republic ELECTRUNITE® are quality made for

HEAT TREATMENT—Carbon tubing is Normalized in a controlled-atmosphere furnace which prevents the formation of scale, and preserves the original flat-rolled steel surface. Again, a uniform product in every way . . . ductility . . . hardness . . . fine grain structure. Stainless tubing receives a full solution heat treatment to obtain maximum corrosion-resistance and ductility. Plus uniform hardness, analysis, and grain structure. Bright annealing facilities are available for the complete range of sizes.

STRAIGHTENING—To insure uniform straightness, Republic ELECTRUNITE Heat Exchanger Tubing is run through a series of concave rolls set at opposing angles. This helps tubing slide through tube sheet holes and baffle plates with minimum effort. To get detailed information on all these operations—including specifications, wall thicknesses, and gages—send in coupon. Or call nearest office.

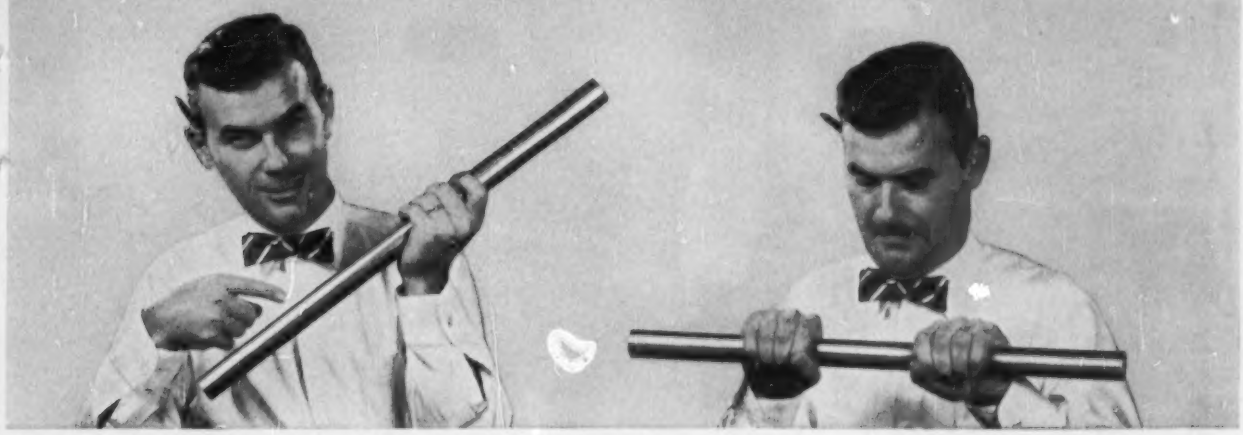
REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

WELDING—*Carbon Steel Tubing* next enters the Electric Resistance Welding machine, where an electric current brings its edges to welding temperature. After joining, the resultant weld is as strong as the wall itself. *Stainless Steel Tubing* is joined by the Inert Arc Weld Process, a technique adapted to the Republic Steel and Tubes Division's own highly critical requirements.

COLD SIZING—The tubing is then squeezed by a series of rolls which insure accurate size to fit the tolerance requirements of tube sheet holes. This operation is typical of the exacting procedures designed to insure Heat Exchanger Tubing of uniform size, roundness, concentricity and, above all, dependability. Every step in the manufacture of Republic Tubing is based on over 50 years of practical experience.



Heat Exchanger Tubes dependable service

TESTING—Finally, each length of ELECTRUNITE Heat Exchanger Tubing, either carbon or stainless, is hydrostatically tested. Carbon Steel Tubes meet all of the requirements of A.S.T.M. Specification A-214. Stainless Steel Tubing meets A.S.T.M. Specification A-249 or A-269. Or you can specify the exclusive FARROWTEST®—a non-destructive electronic testing method that safeguards tubing for critical uses.

THE COMPLETE STORIES on both Republic ELECTRUNITE® Carbon Steel Heat Exchanger Tubes and ENDURO® Stainless Steel Heat Exchanger Tubes are told in these interesting, illustrated booklets. We will be glad to furnish either or both upon request. Simply mail coupon below. Or ask your Republic Sales Office.

STEEL

and Steel Products

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
Dept. C-2179
3116 East 131st Street, Cleveland 8, Ohio

Please send:

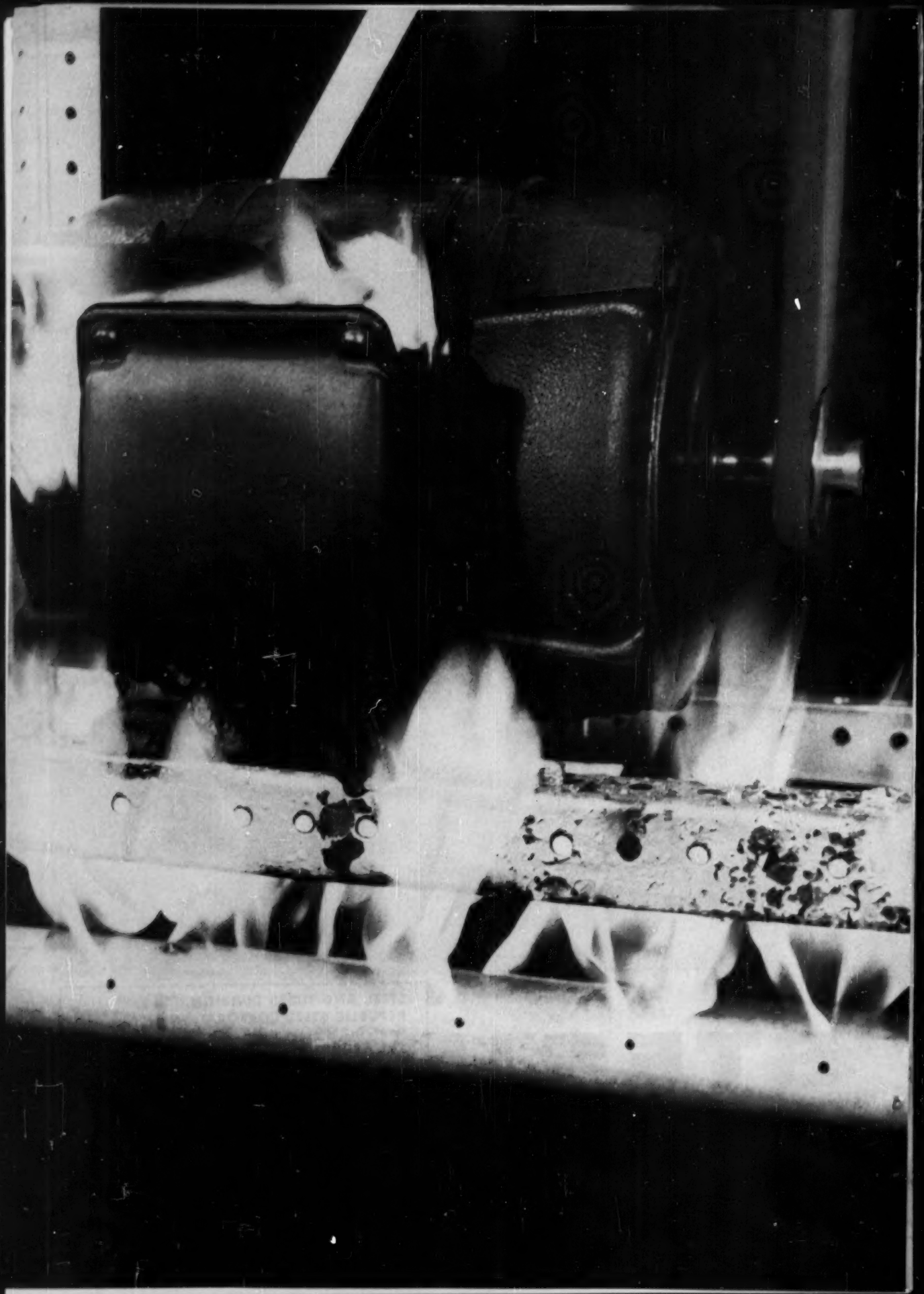
☐ Booklet on Carbon Steel Heat Exchanger Tubes
☐ Booklet on Stainless Steel Heat Exchanger Tubes

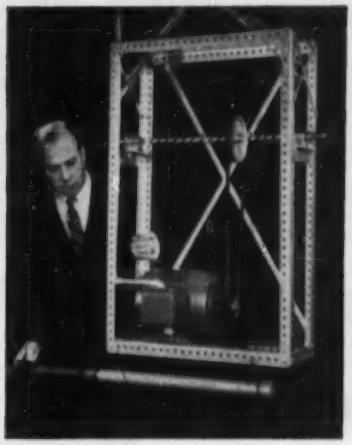
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____





TOMORROW:

A standard motor that can survive infinite heat

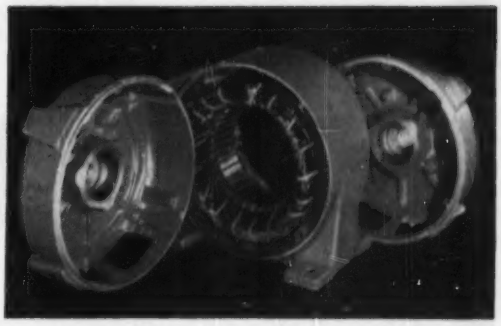
The new Life-Line A is another step closer

Westinghouse is working on tomorrow's motor today. Investigating new materials—testing existing motor designs.

No standard motor today can survive the ultimate test shown here. But we do know that the new Life-Line® "A" can operate under higher temperatures than ever before. It has stronger insulation and better bearing protection than any other motor on the market. It's industry's closest approach to a standard motor that is absolutely heatproof.

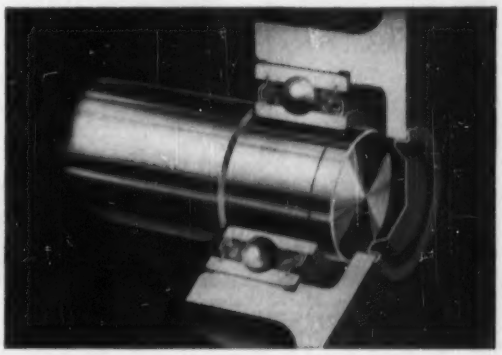
Your Westinghouse sales engineer can show you many additional reasons why the Life-Line "A" is industry's most advanced and preferred motor. Call him today.

J-21926



New fortified insulation includes exclusive Bondar, Bondite and Mylar*—three good reasons why the Life-Line "A" is so resistant to heat or any other motor contamination.

*DuPont Registered Trade-Mark

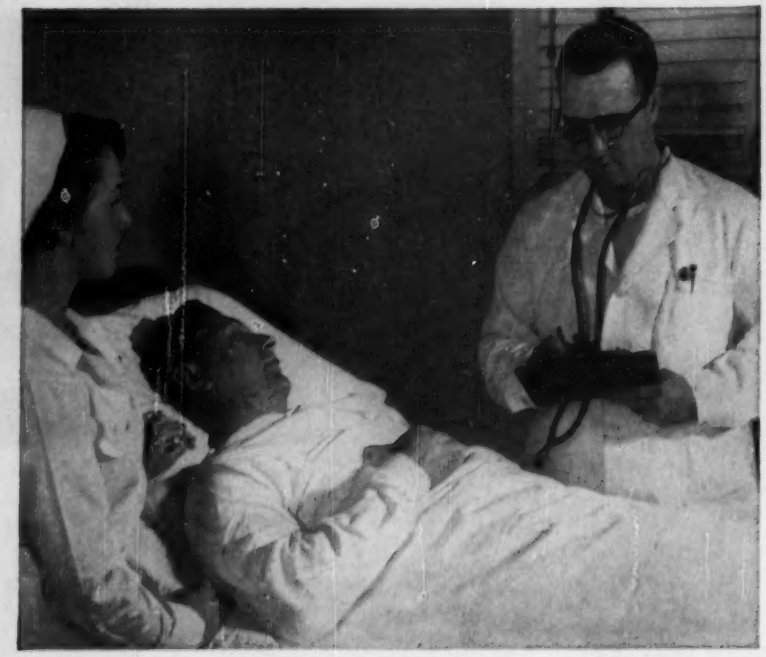


Two outer seals of new 4-way sealed bearing act as flingers and literally throw off damaging contaminations. Inner seals, attached to outer bearing race, are stationary and form a positive labyrinth.

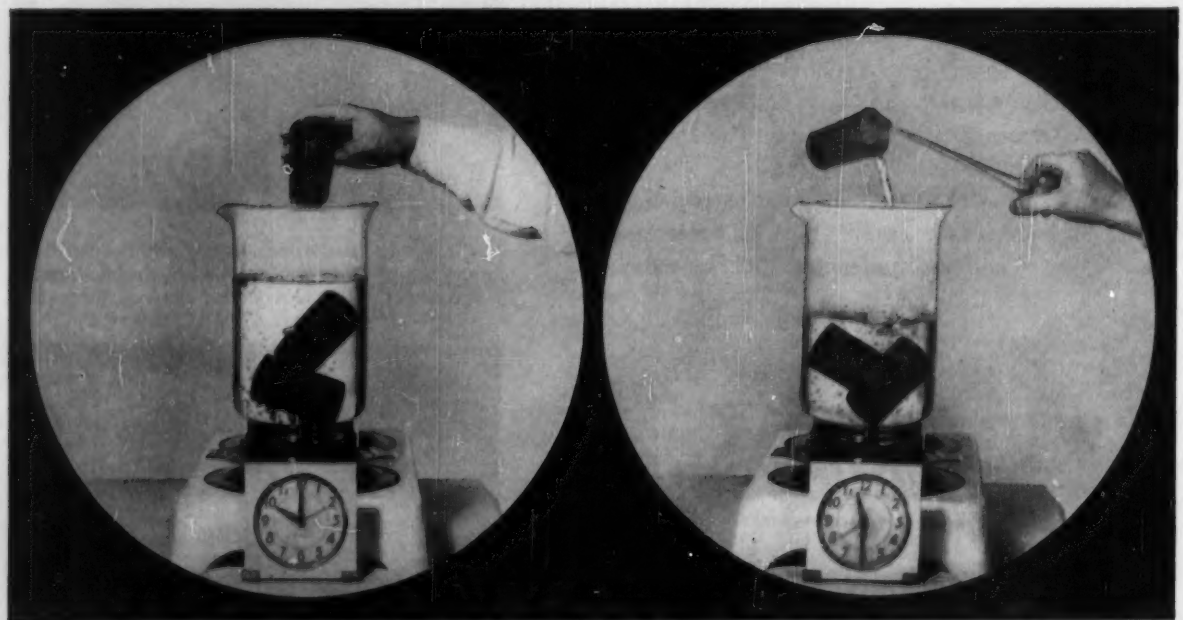
WATCH WESTINGHOUSE!

WHERE BIG THINGS ARE HAPPENING TODAY!

Life on the Chemical Newsfront



DISCOVERY OF TRANQUILIZING EFFECTS of thiazine derivatives has stimulated great interest in new starting materials for their synthesis. A possible source now undergoing research is 2-aminobenzenethiol, a new Cyanamid chemical. A highly reactive, bifunctional compound, it undergoes reactions typical of amino and mercapto groups and where possible, reaction occurs at both groups forming benzothiazole and benzothiazine derivatives. Other reactions are of interest in pharmaceutical, rubber, dye, petroleum and insecticide research. Its amphoteric character leads to salt formation by reaction with bases and acids. Oxidation leads to bis(2-aminophenyl)-disulfide (also available from Cyanamid), long known as a pharmaceutical. 2-Aminobenzenethiol is now offered in pilot-plant quantities. **(New Product Development Department)**



PROLONGED IMMERSION IN BOILING WATER causes no distortion of two new heat-resistant thermoplastic molding compounds demonstrated by Cyanamid at the 7th National Plastics Exposition in June. CYMAC® 400 Polymethylstyrene offers this unusual heat resistance together with the mechanical and electrical properties, clarity, luster, unlimited range of transparent and opaque colors and other desirable properties of polystyrene. CYMAC 201 Methylstyrene-acrylonitrile copolymer offers greater toughness, chemical and craze resistance than CYMAC 400, with high heat resistance, clarity and color range. Both new molding compounds offer the added value of heat resistance at costs no greater than competitive materials. **(Plastics and Resins Division)**

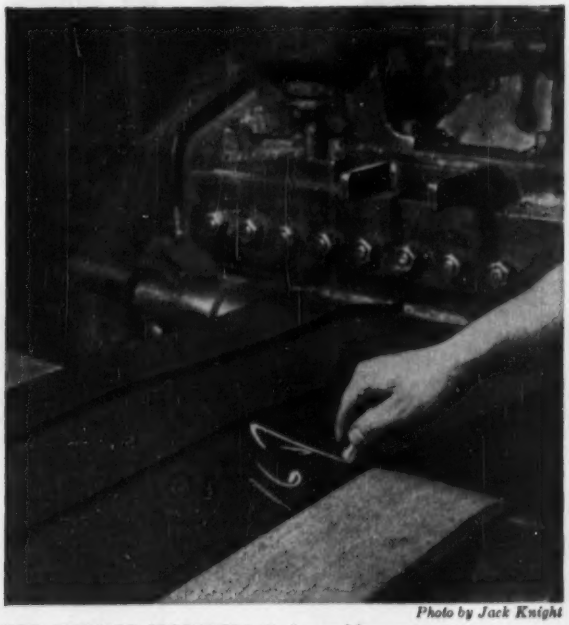


Photo by Jack Knight

HOT, BUT NOT SCORCHED! Higher rubber processing temperatures than ever before are encountered in the use of new, small particle size reinforcing furnace blacks. To prevent scorching in operations such as the extruding process above, a chemical was needed that would delay action beyond anything heretofore developed. Now the maximum in delayed action is offered in Cyanamid's new DIBS* Accelerator (N,N-diisopropyl benzothiazole-2-sulfenamide), available in semi-commercial quantities. With a melting point in the range of 53-59° C, DIBS is easily blended into furnace black stocks. It has good storage stability under normal temperatures. A special report on the behavior of DIBS in furnace black stocks is available on request. **(Organic Chemicals Division)**

UTILITY CAN BE EYE-APPEALING, TOO. Now tough, unbleached kraft corrugated cartons are coated with pigmented overlay coatings. In such applications, PAREZ® Resin 613 is used to help insolubilize the coating to give improved wet-rub resistance. With this protection, bright, even, solid color printing is possible which weathers scuffing in shipment, rough handling, even soaking rain, and still comes out bright with the manufacturer's label or message intact. **(Industrial Chemicals Division, Dept. B)**

*Trademark

PRELIMINARY STUDIES OF FUNGICIDES made up of *s*-triazine derivatives of cyanuric chloride indicate the great versatility and potential of this chemical. 2,4-Dichloro-6-(*o*-chloroanilino)-*s*-triazine† has been shown to be extremely effective against tomato blight fungus and other leaf and turf diseases. Many other derivatives made possible by the high selective reactivity of the chlorine substituents of cyanuric chloride and the extreme stability of the triazine ring are leading to new developments in insecticides, plastics and resins, pharmaceuticals, dyestuffs, surfactants, rubber chemicals and other fields. For a comprehensive roundup of recent work, send for "Cyanuric Chloride Derivatives." **(Industrial Chemicals Division, Dept. B)**

†U. S. Pat. No. 2,720,466

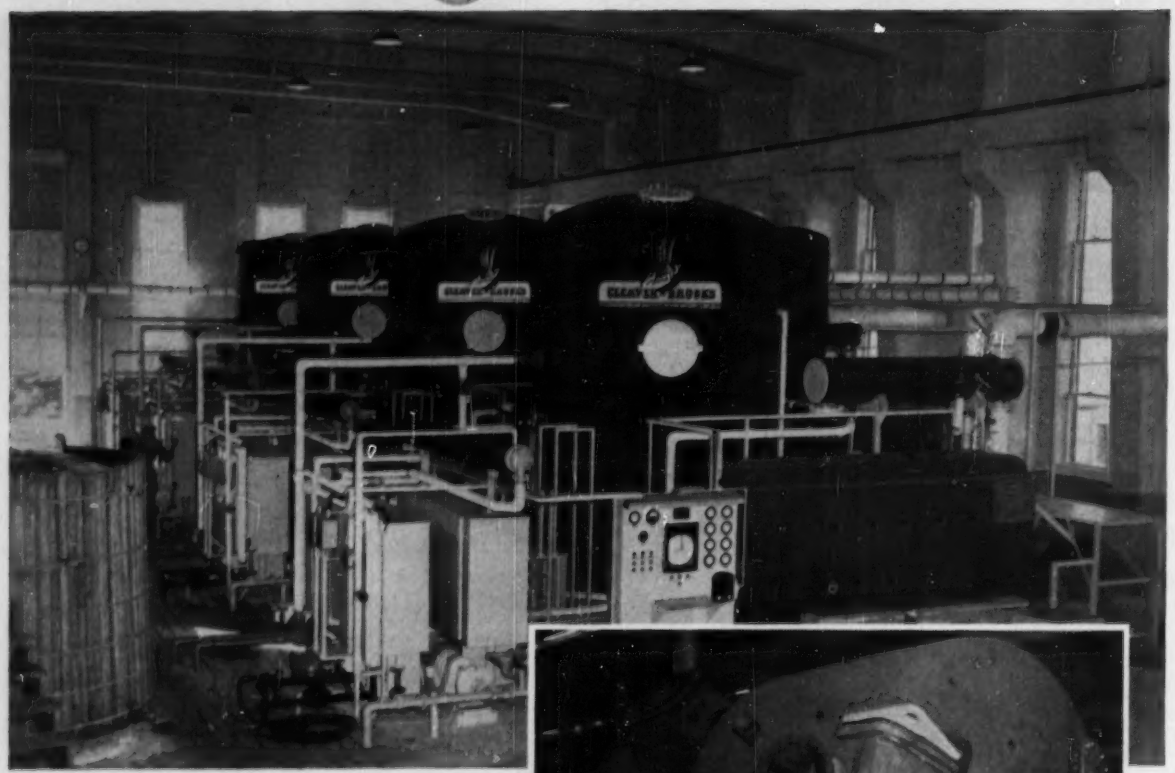
CYANAMID

AMERICAN CYANAMID COMPANY
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Additional information may be obtained by writing on your letterhead to the Division of American Cyanamid Company indicated in the captions.

Building for the Future Through Chemistry

World's



BATTERY OF CLEAVER-BROOKS EVAPORATORS IN ACTION—Revere Silicon Bronze was chosen for these evaporators and their component parts because of its high corrosion resistance and non-contamination properties, great strength and weldability. All of the components, as well as the 4 evaporator shells, are made of Revere Silicon Bronze Alloy No. 420.

ONE OF THE 4 EVAPORATOR SHELLS made of Revere Silicon Bronze, fabricated and installed by CLEAVER-BROOKS MFG. CORP., Waukesha, Wisconsin.

EIGHT TUBE SHEETS LIKE THESE were used in the Bermuda installation . . . 2 per evaporator. Each tube sheet, made of Revere Silicon Bronze, is 86" in diameter, 1¼" thick and weighed approximately 1,360 lbs. after drilling.

Largest

VAPOR-COMPRESSION SEA WATER DISTILLATION PLANT

Made and installed by CLEAVER-BROOKS

. . . Vital distillation units fabricated from REVERE SILICON BRONZE

This plant installed at the Kindley Air Force Base in Bermuda has a total daily capacity of 200,000 gallons and eliminates the dependence of the Base on rainfall or shipment of water by tankers.

Distilled water is produced in the ratio of 300 lbs. to each pound of Diesel fuel. Total costs are estimated at $1.25 per thousand gallons of distilled water. Nearly every component part made by Cleaver-Brooks is about twice the size of its largest previous counterpart. For example, the evaporators are 16½ feet high. Each, with its component parts, weighs approximately 40,000 lbs., the empty Revere Silicon Bronze shell alone accounting for 28,000 lbs.

There is an interesting story behind the development and manufacture of this equipment. The four huge pressure vessels had to be fabricated of Revere Silicon Bronze Alloy No. 420. Knowing Revere's wide experience in welding copper-base alloys, Cleaver-Brooks called in a Technical Advisor, and gave him a complete set of blueprints of the vessels, with a request for suggestions regarding joint design and welding techniques. He in turn consulted the Welding Section of the Revere Research Department. Their recommendations were adopted, and the customer reported that the original estimate of welding time had been cut considerably, reducing production costs correspondingly.

The Revere Technical Advisory Service is glad to collaborate on problems involving the specification and fabrication of copper and copper-base alloys, and aluminum alloys. See the nearest Revere Sales Office.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

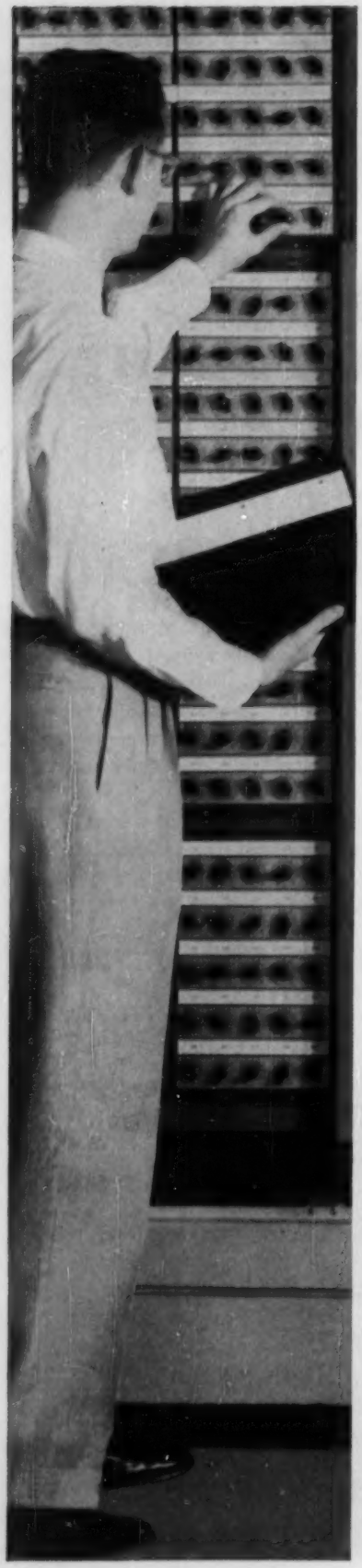
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER • BRASS • 18 01 • REVERE • ALUMINUM

THE STEAM SEPARATORS are identified by their conical tops and directional vanes. They are of the cyclone type, which is a patented feature of CLEAVER-BROOKS evaporators, and remove entrained water from the steam, thus preventing contamination of the fresh water coming from this unit. The result is an extremely high purity of the fresh water product.

The rectangular objects at rear of photograph are the "Downcomers" which bring water down from the top of the steam separator. The tubes in left foreground are "Hotwells," which receive the distilled water discharge from the evaporator shell.



Panalog Information Systems guide management in raising plant output and profit

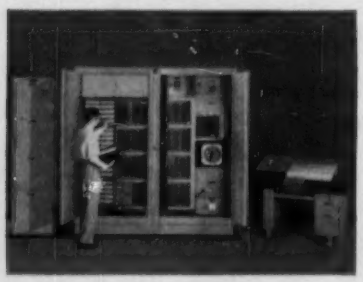
Panalog 605 Information System supplies management control information. Now, operating personnel and management can receive organized digital information on any process, instantly and continuously. Information can be presented in a variety of forms for immediate control action as well as for engineering and accounting analysis. A typical presentation method employs an electric typewriter and patented log chart. Readout can also be made on punched or magnetic tape, punched cards, or can be fed directly to computers.

Periodically logs and continuously scans. A precision servo measuring system quantizes process variables during automatic, periodic logging. A high-speed electronic measuring system detects off-normal conditions during continuous scanning of all variables. Normal and return-to-normal values are printed in black—off-normals in red. A complete log of all variables as well as a summary of off-normals can be made at any time.

Completely flexible and expandable. Panalog components are standardized, packaged modules. The system can be easily expanded or modified in the field. The Panalog 605 is sufficiently flexible to supply digital information for any management requirement.

Write for literature. Literature presenting a comprehensive treatment of the Panalog 605 is available. If you wish, a Panellit representative in your area will be happy to discuss the possibilities that a Panalog Information System offers your company.

Full scale, adjustable, high and low off-normal limits are provided for each input variable. Basic system capacity, 200 points with one electric typewriter — can be expanded. Accuracy, ± 25% of full scale range. Logging speed, approximately one line per minute. Scanning speed, five points per second, between logs.



Logged values are grouped by processing unit on chart. Audio-visual alarms accompany detection of off-normals. When scanning, off-normal values are identified and printed in separate chart area. Totalized and averaged values as well as plant efficiencies can be automatically computed and recorded by the system.

U.S. Pat. No. 2,701,748

Engineered Information Systems For Industry

Graphic Panels Control Centers

Panalarm Annunciators

Instrument Services Division

PANELLIT

PANELLIT, INC.

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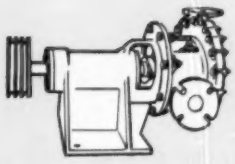
Panellit of Canada Ltd., Toronto 14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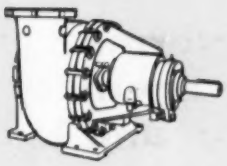
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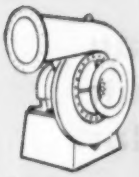
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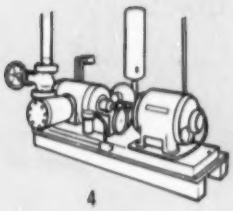
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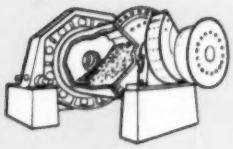
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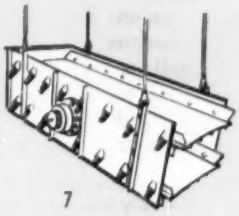
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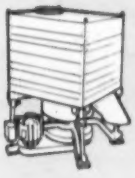
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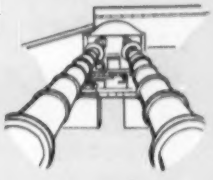
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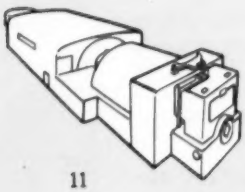
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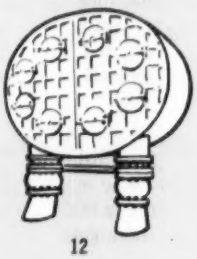
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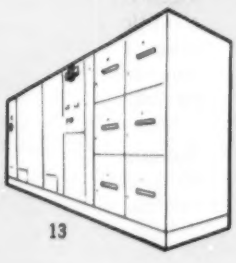
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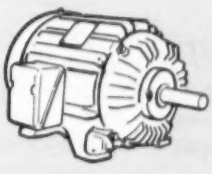
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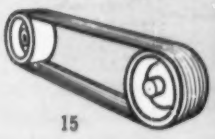
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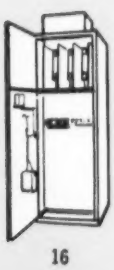
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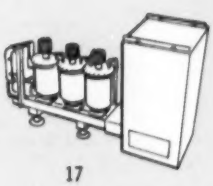
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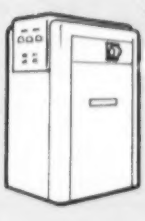
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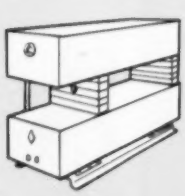
. . . What single manufacturer builds all this equipment for the **CHEMICAL PROCESSING INDUSTRIES?**

A-5111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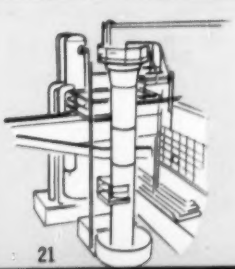
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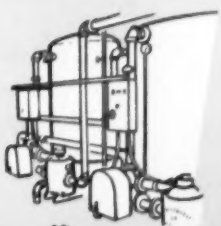
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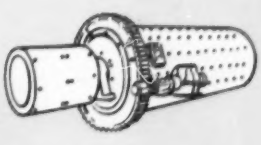
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24

Improve Product Quality, Streamline Production,

in hundreds of different

GYRATORY CRUSHERS

"One-man, one-minute" product control, a feature of Allis-Chalmers primary, secondary and tertiary gyratory crushers, slashes setting changing time from hours to seconds. Size adjustment, compensation for wear and emergency unloading are accomplished by the flick of a switch.

Other A-C crushers include complete size ranges in five types of jaw crushers, a line of roll crushers and an impact hammermill.

GRINDING MILLS

Whether your process calls for individual mills or a grouped stage grinding series, Allis-Chalmers can make a right-for-the-job recommendation from *seven different types* of grinding mills.

VIBRATING SCREENS

Allis-Chalmers vibrating screens are built in single and multiple-deck models for use in scalping, wet or dry sizing, washing, rinsing, dewatering, and media recovery. Auxiliaries or modifications include step decks, pool washing decks, heat expanding decks, decks designed to prevent blinding, special dust enclosures, water-cooled mechanisms, automatic stop control.

BLADE MILLS

Designed for large tonnages of hard-to-wash materials, blade mills effectively disintegrate and wash into suspension tenacious clays and other unwanted substances.

CENTRIFUGAL PUMPS

More than 60 years' experience in designing centrifugal pumps goes to work for you when you specify Allis-Chalmers. The line includes process and solids handling pumps as well as general purpose types.

ROTARY KILNS

All welded, one-plate-to-a-circle construction, patented heat recuperation, effective air seals, centralized control, air-cooled feed and discharge ends — these are some of the many improvements engineered by Allis-Chalmers that make the rotary kiln the most efficient method of pyro-processing.

ROTARY DRYER-COOLER

This versatile equipment is particularly applicable in drying or cooling heavy or high moisture content materials. It dries with a parallel flow and cools with a counterflow. Available in direct, indirect, or direct-indirect types. Allis-Chalmers also builds tube-type rotary coolers and air-quenching grate coolers.

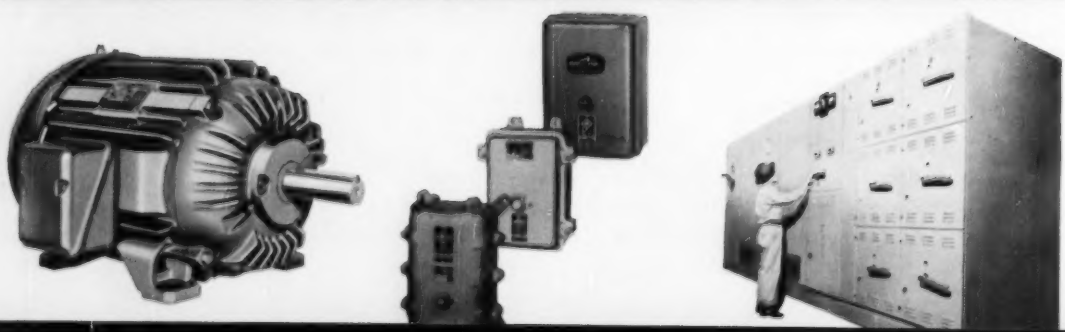
GYRATORY SCREENS

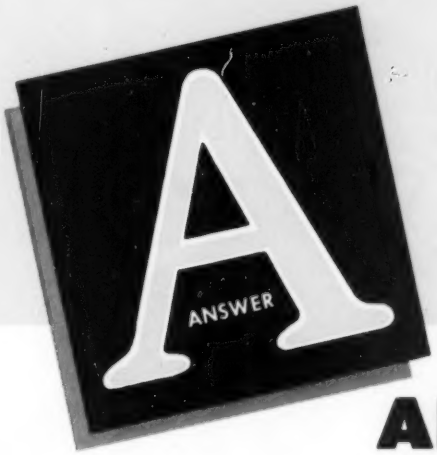
All-metal unit is designed to separate dry granular materials into two, three and four predetermined sizes. Stacked sieve design facilitates quick product change-over and simplified sanitation.

COMPACTING MILLS

Used to produce paper-thin flakes or to increase the apparent density of your product. There's an Allis-Chalmers mill specifically designed to handle a wide variety of grinding, crushing, rolling or compacting jobs in the chemical processing industries.

. . . all completely integrated with the required electrical equipment.





ALLIS-CHALMERS

. . . manufactures the most complete and diversified lines of equipment for unit operations

Allis-Chalmers builds equipment for liquid handling, air and gas handling, size reduction, wet and dry screening, washing, pyro-processing, materials handling. Equipment recommendations are based on the coordinated thinking and planning of various engineering groups at Allis-Chalmers. This unique service "teams up" new equipment with existing equipment in your operation. Electrical equipment, too, is integrated into each process. Responsibility for efficient operation rests with just one manufacturer — a big advantage.

There's No Guesswork

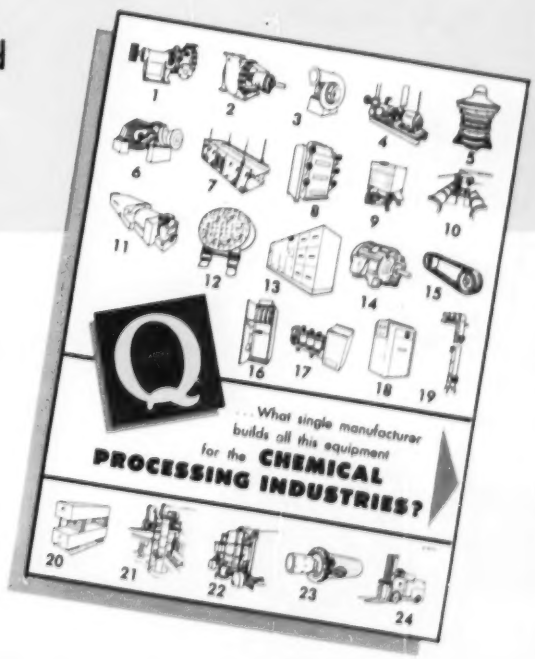
In working with your staff or consultants, your A-C representative uses the technical skill and experience of the many Allis-Chalmers engineering departments. Their recommendations are backed by research, by testing and pilot plant facilities, by the "know-how" gained in solving thousands of equipment application and coordination problems.

Unbiased Recommendations

Because Allis-Chalmers builds many types and sizes in a given line, equipment selection is dictated only by your specific needs.

Most important is the fact that Allis-Chalmers interest in your problem does not stop when your equipment is installed. Periodic check-ups, maintenance and technical advice, fast emergency parts service, are yours continuously.

How many pieces of Allis-Chalmers equipment did you identify in the cover illustration?

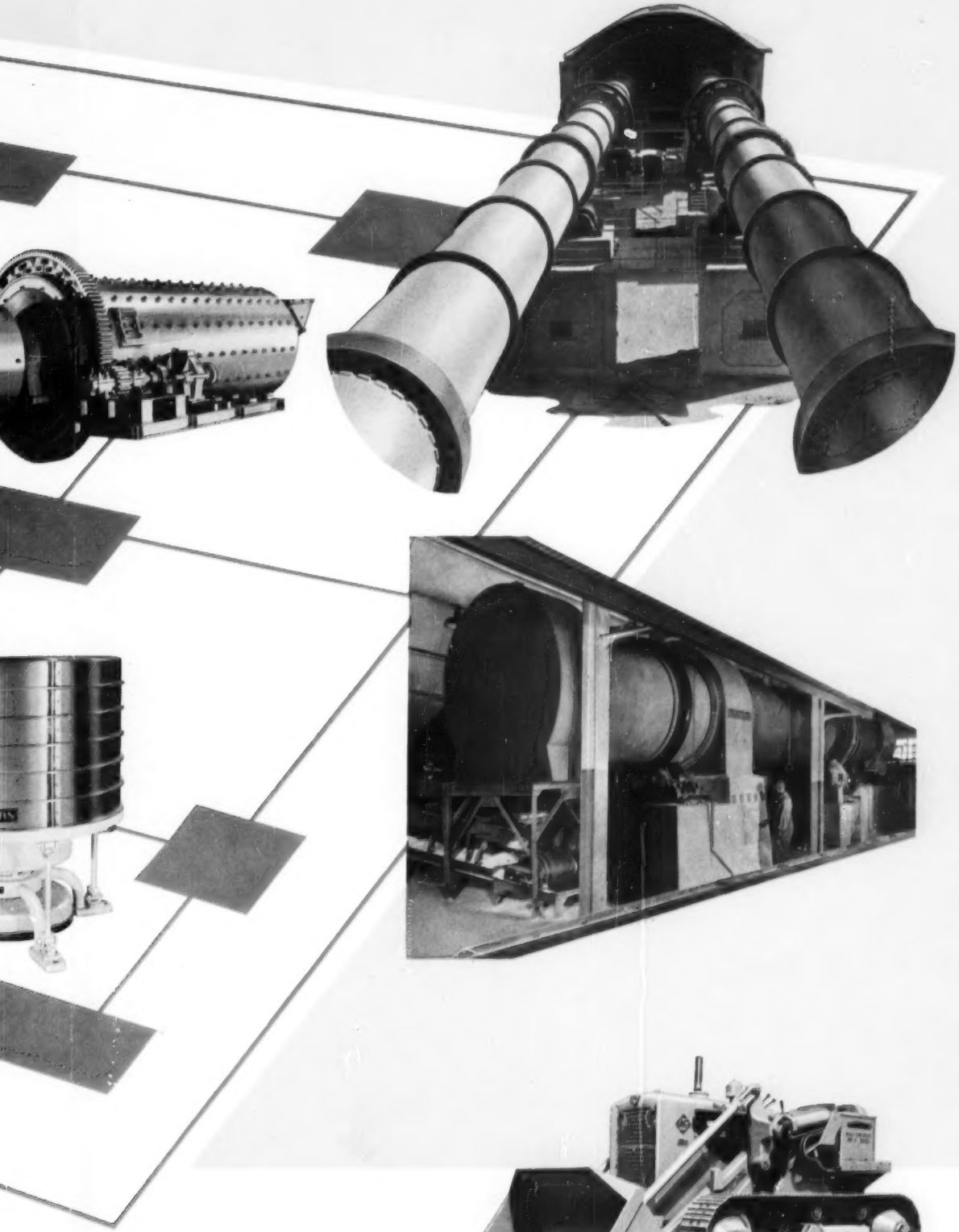


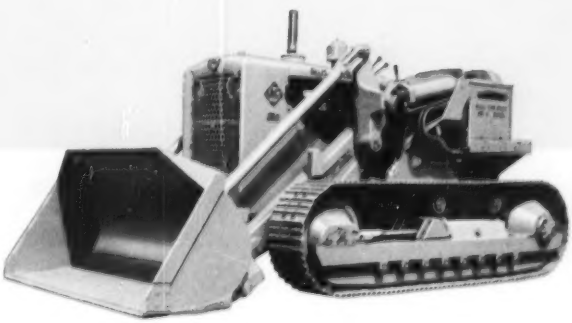
1. Process Pump; **2.** Solids Handling Pump; **3.** Centrifugal Blower; **4.** Rotary Compressor; **5.** Gyratory Crusher; **6.** Grinding Mill; **7.** Vibrating Screen; **8.** Roller Mill; **9.** Gyratory Screen; **10.** Rotary Kiln; **11.** Turbine Generator; **12.** Condenser; **13.** Unit Substation; **14.** Explosion-Proof Motor; **15.** V-belt Drive; **16.** Motor Control; **17.** Mercury Arc Rectifier; **18.** Dielectric Heater; **19.** Manlift; **20.** Metal Detector; **21.** Continuous Contact Column (for liquid-solids separation); **22.** Water Conditioning Equipment; **23.** Blade Washer; **24.** Lift Truck.

Increase Profits . . .

operations

ALLIS-CHALMER





RS

A-C ALLIS-CHALMERS

Equipment for Materials Handling

Thousands of world famous Allis-Chalmers tractors, tractor shovels, lift trucks, bulldozers and scrapers are working indoors and out in the chemical processing industries.

You get **MORE** than equipment when you specify

ALLIS-CHALMERS

The "plus" you get is the Allis-Chalmers approach to equipment application. It's called "*coordineering.*" As manufacturers of a most diversified line of processing and electrical equipment Allis-Chalmers maintains separate departments, each staffed with specialists, for each product. "Coordineering" is an advantage that results from an interdepartment exchange of ideas and the correlation of specific skills . . . the integration of thinking, planning and engineering that precedes the application of your integrated equipment.

Write for Literature

A 32-page bulletin (25C6177) covers all Allis-Chalmers equipment for the process industries. This bulletin, as well as literature covering specific equipment lines, may be obtained from the Allis-Chalmers representative in your area or by writing Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

"DO-IT-YOURSELF" CAUSTIC SODA

A new process using Glycerine, still in the laboratory stage, shows promise of solving a by-product recovery problem in the chemical industry.

For every ton of fiber produced by rayon manufacturers, more than a ton of sodium sulfate is produced. At the same time, rayon plants consume large amounts of caustic. In the past, chemists have tried unsuccessfully to find an *economical* way of converting sulfate into much-needed caustic.

Recent experiments have shown that significantly higher yields of caustic soda may be obtained by treating sodium sulfate with slaked lime—*in Glycerine solution.*

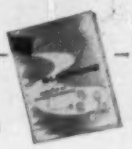
The new process takes advantage of Glycerine's solvent and dispersing abilities. Continuing research with these properties of Glycerine may uncover practical by-product recovery processes of a similar nature for still other industrial chemicals. The unique balance of properties that has won such wide acceptance for Glycerine in the past continues to open new doors to chemical progress. In paints, foods, pharmaceuticals, packaging . . . for tomorrow's surge of new specialties . . . in formulations and reactions yet unknown, nothing takes the place of Glycerine.

This balanced group of properties keeps **Glycerine's** usefulness growing

HYGROSCOPICITY • STABILITY •
SOLVENT POWER • VISCOSITY • NONVOLATILITY •
NONTOXICITY • TASTE • MW/HYDROXYL RATIO •

HUMECTANT •
CARRIER • SOLVENT • LUBRICANT • SOFTENER •
EMOLLIENT • ANTI-FREEZE • ALKYD BASE •

☑ CHECK AND SEND FOR TECHNICAL DATA

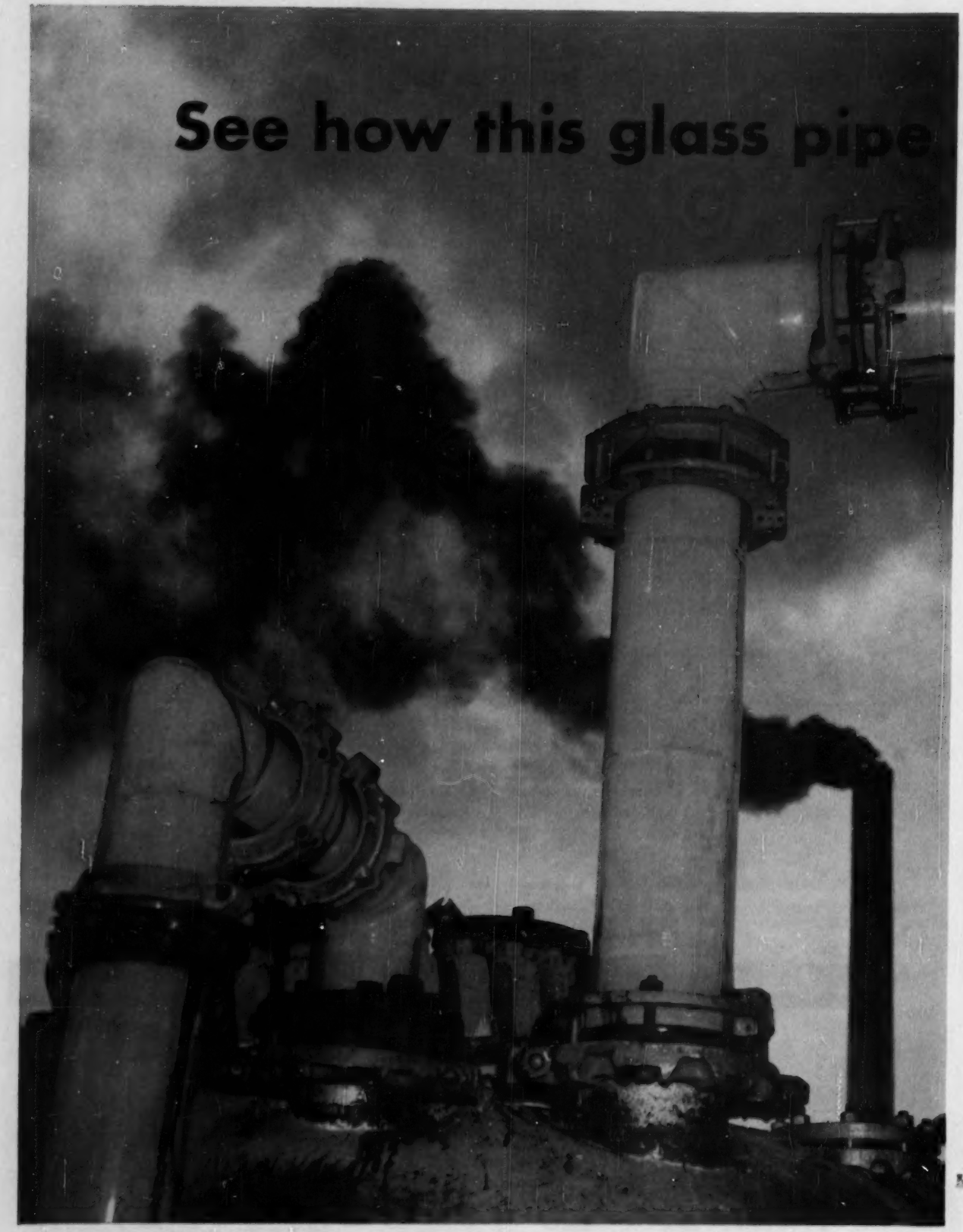


☐ 20-page booklet on Glycerine for product conditioning

☐ 8-page booklet on "Federal Specifications for Glycerine"

☐ 16-page booklet on Glycerine properties and applications

For your free copy of any or all of these booklets write: **GLYCERINE PRODUCERS' ASSOCIATION** • 295 Madison Ave., New York 17, N.Y.



PYREX pipe does a superior job handling such acids as sulphuric, hydrochloric, nitric and acetic; and such materials as chlorinated hydrocarbons, hydrogen peroxide, bromine, brines and metallic salts of all concentrations.

stands up to one of the toughest corrosives of all

This Crosby Chemical Co. case history, involving the successful handling of extreme corrosives, may help you cut corrosion in your plant.

At its DeRidder, La. plant, Crosby pipes chlorinated resins at 15" Hg vacuum. Temperatures are 70° to 250°F.

With conditions like these, you could reasonably expect frequent pipeline replacement, high maintenance costs—and all the other usual problems you face in handling severe corrosives.

Yet Crosby's lines have been in service 3 years. Scaling is nonexistent. They've never been cleaned. Maintenance costs hardly exist. Reason: they're PYREX *brand "Double-Tough" glass pipelines.*

So well pleased are the Crosby folks with glass pipe performance, they now use it in a new plant at Picayune, Miss.

Name your corrosive

You can transfer just about any corrosive you handle today—or will handle in the future—in corrosion-proof glass pipe. Only exceptions are hydrofluoric acid and hot concentrated alkalies.

And this same chemical inertness may give you still another important reason to choose glass. *Glass pipe neither adds to nor takes from sensitive fluids.* You can end contamination with it. It puts an end to metal pickup.

What about pressure, temperature?

If you have to pipe hot fluids and fluids under pressure, this table shows how far you can go with glass pipe. It shows, too, how much tolerance you can allow for thermal shock.

When you install PYREX brand glass pipe in your plant, you'll be joining hundreds of other firms who have used it for as long as 30 years. You'll start immediately to collect the savings that come whenever you cut corrosion out of a process.

Help close by

Near you is a distributor of PYREX brand pipe. He'll be glad to help you evaluate its place in your plant. At your convenience, he'll arrange for you to see an actual installation.

For his name, and for detailed information, send us the coupon today.

How you install glass pipe—PYREX brand "Double-Tough" glass pipe is as easy as any other pipe to install, actually easier than the heavyweight pipe material you may be using now. Even if your usual pipe fitters have never seen glass pipe before, they'll be able to install it readily.

RECOMMENDED WORKING PRESSURES—TEMPERATURES

Pipe Size	Maximum Recommended Working Pressure	Maximum Sudden Temperature Differential	Maximum Operating Temperature
1"	50 p.s.i.	200° F.	450° F.
1½"	50 p.s.i.	200° F.	450° F.
2"	50 p.s.i.	200° F.	450° F.
3"	50 p.s.i.	200° F.	450° F.
4"	35 p.s.i.	175° F.	450° F.
6"	20 p.s.i.	160° F.	450° F.

No installation too complex—Inside your plant or out, long lines, manifold systems, tricky turns, or involved equipment hookups—you can get all the fittings you are most likely to need from your distributor.

CORNING GLASS WORKS
CORNING, N.Y.
Corning means research in Glass

CORNING GLASS WORKS, 17 Crystal Street, Corning, New York

Please send me more detailed information on PYREX brand "Double-Tough" glass pipe ☐; send name of nearest PYREX pipe distributor ☐.

Name..... Title.....

Company.....

Street.....

City..... Zone..... State.....

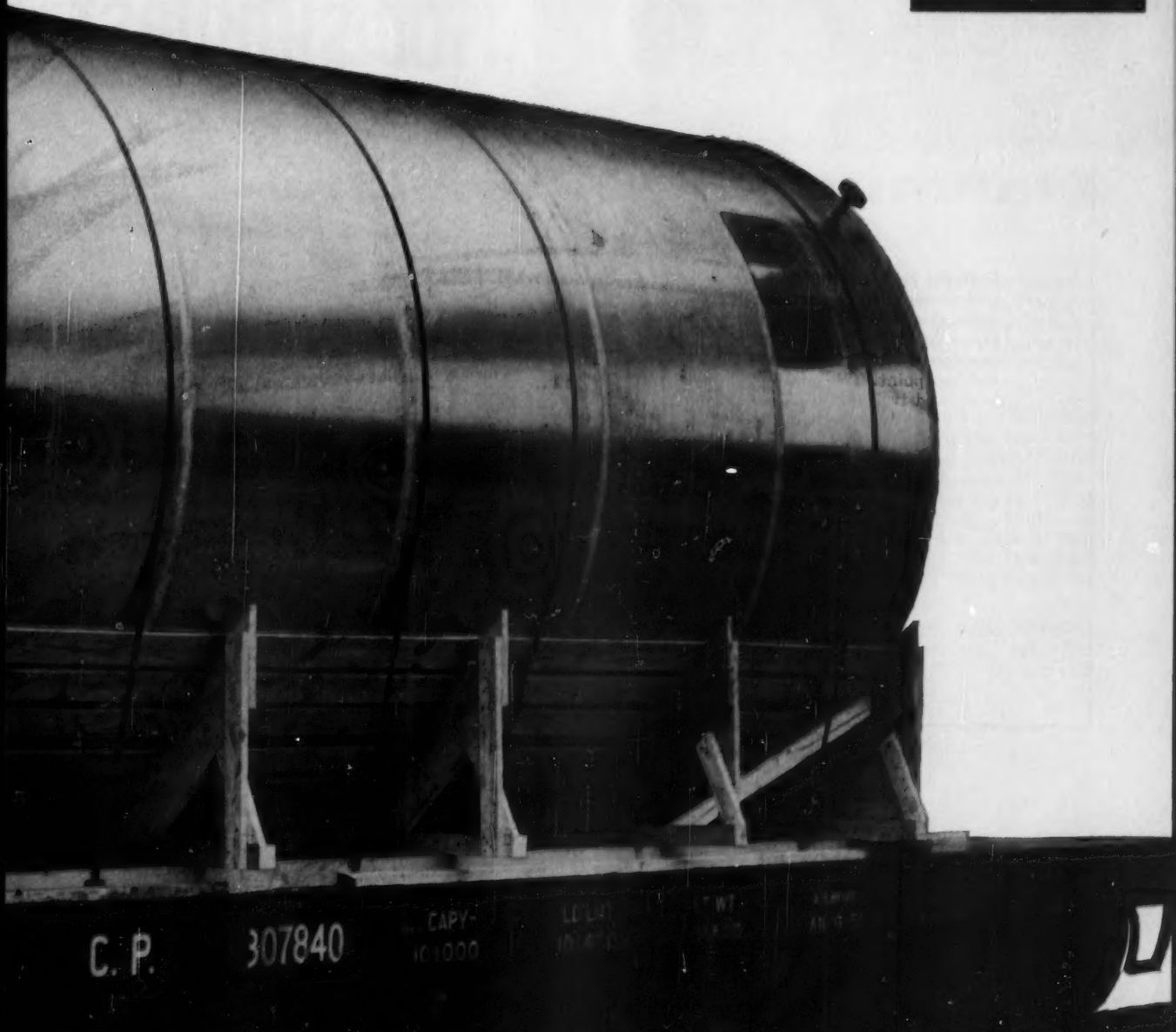
BRIGHTON BUILDS THE BIG ONES...

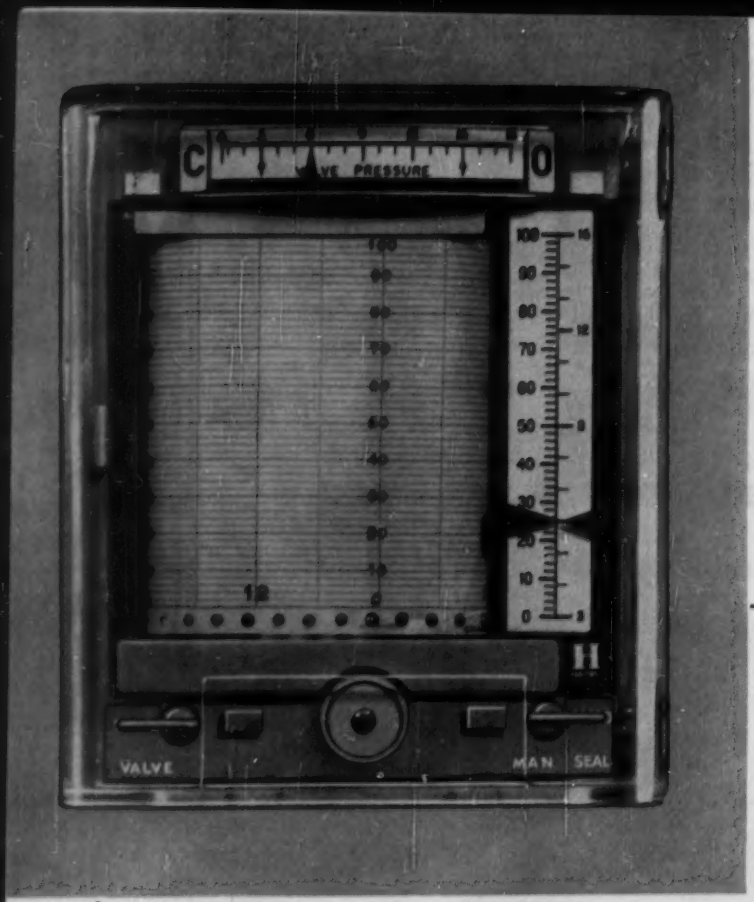
and delivers them on time. This tank is one of two built by Brighton for the Forest Products Chemical Co., Memphis, Tennessee. Fabricated of 3S aluminum, it has a capacity of 17,000 gallons and is used to store acetic acid.

"Delivery on the date promised resulted in considerable cost savings. Production started right on schedule. Brighton built exactly to our specifications . . . an excellent job of fabrication," reports Clyde B. Herrington of Forest Products Chemical Co.

Brighton has the facilities and skilled metalsmiths to build chemical process equipment of virtually any type and size—pilot model to full scale. Typical examples are fractionating columns, heat exchangers, pressure vessels, agitating equipment, kettles, coils and evaporators. Have Brighton Bid Your Big Ones! Write today for full information.

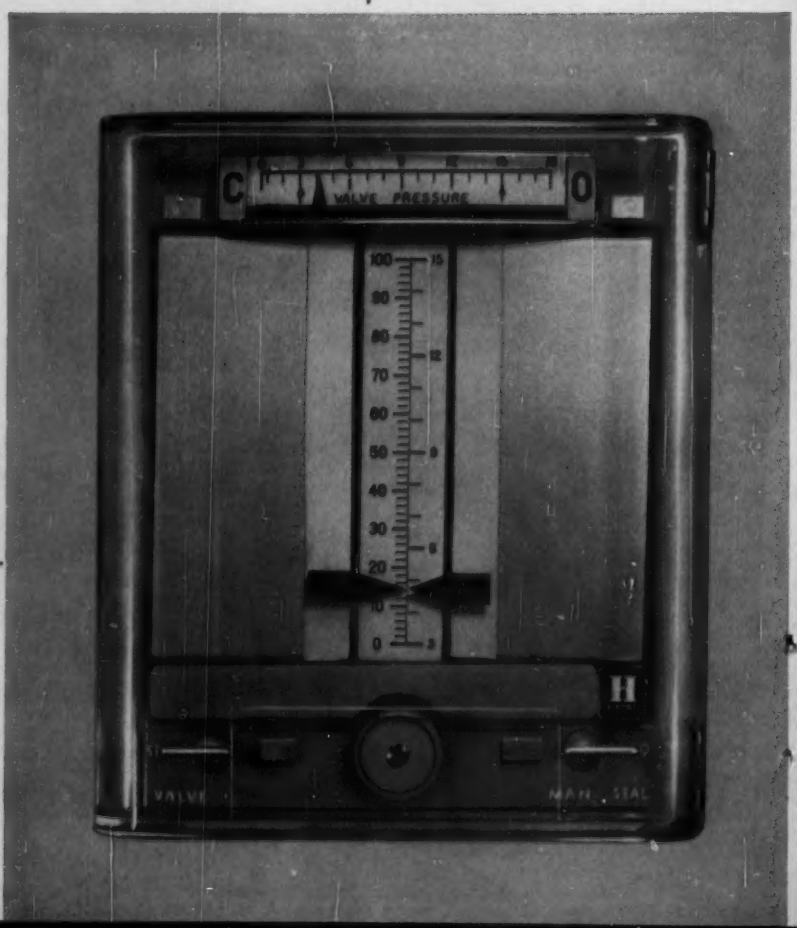
BRIGHTON COPPER WORKS, INC.
822 State Avenue, Cincinnati 4, Ohio
Process Equipment for the Chemical Industries Since 1914





for simplest

Both the *Tel-O-Set* indicator and recorder have vertical indicating scales on which large, opposing pointers clearly show measured value and set point. The control knob and transfer switches are located near the bottom of the case, where they can be manipulated without the operator's hand obscuring the view of the pointer and scale.



● **REFERENCE DATA:**

Write for Bulletin 7202.

Design your instrumentation

installation, startup, service

-with *Tel-O-Set* instruments

The exclusive features designed into *Tel-O-Set* miniature instruments save you time, trouble and money . . . from the instant these instruments are installed on your control panels.

Easy installation. The indicating and recording chassis is a complete assembly that can be supplied separate from the case. Since the case contains the valve pressure gage and pressure regulator, you can install it in the panel, make complete piping connections . . . and then insert the instrument chassis later, at startup.

Foolproof startup. Because it can be shipped separately, the chassis is protected against dirt and damage until it is ready to begin service. Air lines can be checked, control valves stroked and final inspection made *before* the chassis and controller are installed.

Serviced in seconds. Down-time for instrument maintenance is eliminated, for a complete chassis can be replaced in just a few seconds. There is no loss of control during replacement . . . no disturbance to electrical connections. To adjust zero and span, or to inspect parts, you can partly withdraw the chassis from the case, without interrupting operation.

Tel-O-Set instruments can handle a broad range of temperature, pressure, flow and liquid level applications. They work with any type of pneumatic force-balance controller. They are sensitive and accurate . . . have true linear calibration . . . respond instantly to changes in measured variables. For a discussion of how you can use them profitably, call your local Honeywell sales engineer . . . he's as near as your phone.

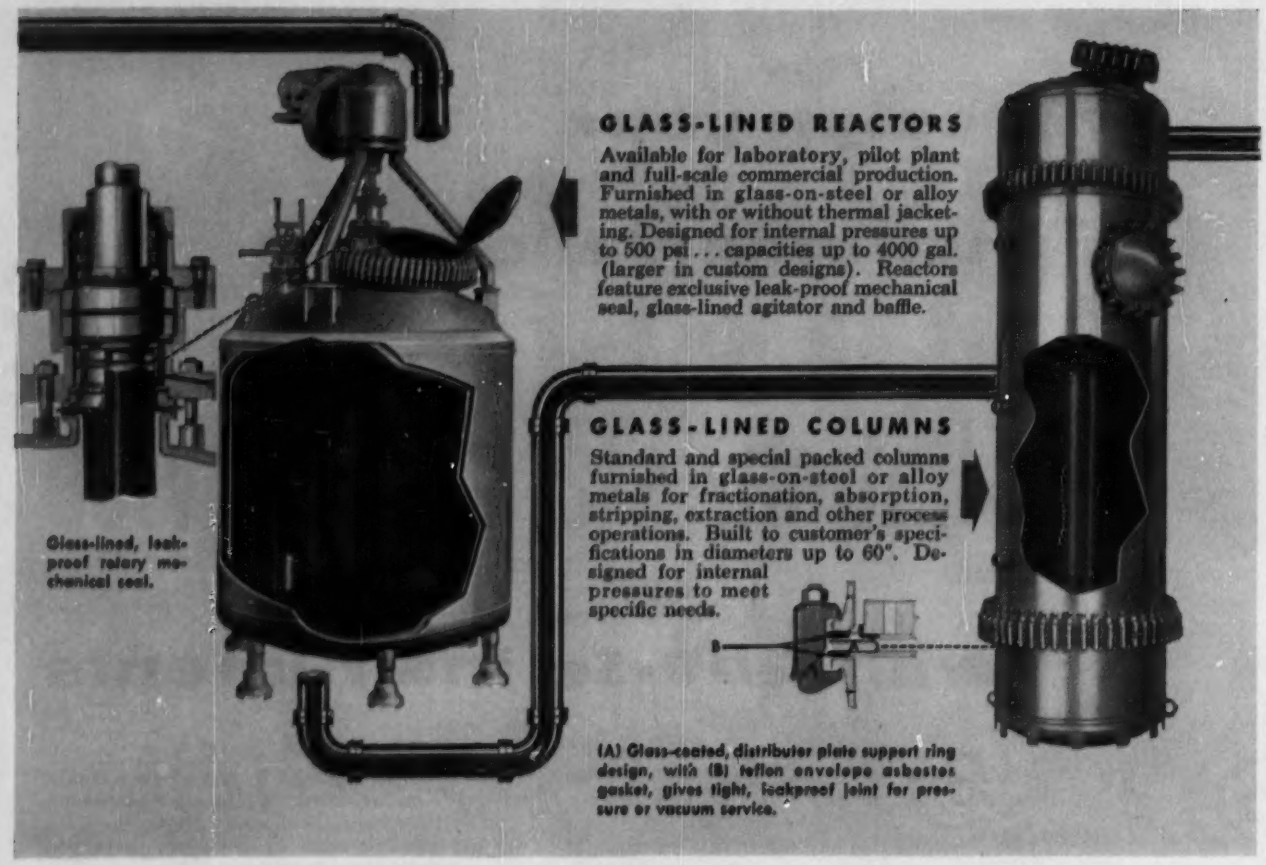
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Whatever your process . . . insist on Glascote glass-lined products



Glass-lined, leak-proof rotary mechanical seal.

GLASS-LINED REACTORS

Available for laboratory, pilot plant and full-scale commercial production. Furnished in glass-on-steel or alloy metals, with or without thermal jacketing. Designed for internal pressures up to 500 psi . . . capacities up to 4000 gal. (larger in custom designs). Reactors feature exclusive leak-proof mechanical seal, glass-lined agitator and baffle.

GLASS-LINED COLUMNS

Standard and special packed columns furnished in glass-on-steel or alloy metals for fractionation, absorption, stripping, extraction and other process operations. Built to customer's specifications in diameters up to 60". Designed for internal pressures to meet specific needs.

(A) Glass-coated, distributor plate support ring design, with (B) teflon envelope asbestos gasket, gives tight, leakproof joint for pressure or vacuum service.

Glass-lining gives the ultimate in corrosion-resistance . . . zero contamination . . . lower cost through longer service life

YOU can use Glascote glass-lined equipment — from start to finish — for processing a variety of corrosive materials. Glascote's glass-linings put an end to contamination.

Whatever your processing system, you, too, will find it profitable to use Glascote's glass-lined equipment — pipe and fittings, reactors, columns, storage tanks, rotary dryer-blenders, etc. All designed for dependability, durability, flexibility of application and economy of operation.

What's more, you can be sure of product purity, because Glascote's chemical-resistant, acid-alkali glass offers greater resistance to corrosive action . . . greater versatility for processing products. And Glascote also offers you non-stick glass which is ideal for polymer production of all types.

Remember, for efficient heat transfer and extra-long service life insist on Glascote glass-lined products.

Ask the representative who calls on you for all the facts about Glascote products—reactors, storage tanks, columns, conical rotary dryer-blenders, receivers, condensers and accessory products. Or, if you prefer, write direct. Glascote Products, Inc., Cleveland 17, a subsidiary of A. O. Smith Corporation.

Our standard one year guarantee continues to apply to all Glascote glass-lined products.

Glascote®

PRODUCTS, INC.

CLEVELAND 17, OHIO

Sales offices or agents located in New York • Philadelphia • Union, N. J. • Chicago • Cleveland • Dayton • Houston • Los Angeles
Export Sales: A. O. Smith Corp., International Div., Milwaukee 1, Wis.

from START to FINISH

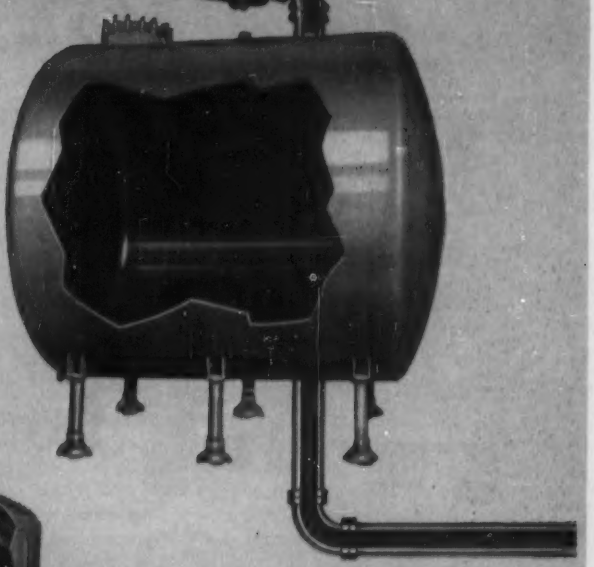
GLASS-LINED HEAT EXCHANGER TUBES

Efficient, corrosion-resistant Heat Exchangers are assembled from lengths of standard diameter jacketed pipe. Adequate heat transfer area is available for most applications using various heating and cooling media. The use of either elbows or return bends provides a versatile operating assembly.

GLASS-LINED STORAGE TANKS

Single shell glass-lined *horizontal* furnished in standard units in capacities up to 6000 gal. (larger on special order).

Vertical glass-lined units furnished in four standard structural types—plain and jacketed, open and closed. Standard tanks built in capacities up to 6000 gal. (larger on special order).



GLASS-LINED PIPE AND FITTINGS

Glascote produces and stocks glass-lined pipe in 10' lengths and fittings to ASME standards, in inside diameters from 1½" to 4". Six and 8", and larger sizes are fabricated to order. Leakproof gaskets available to suit material conveyed in pipe.

GLASS-LINED CONICAL, ROTARY DRYER-BLENDERS

Standard acid-alkali, glass-lined, conical, rotary Dryer-Blenders available in capacities — 5 and 35 cu. ft. and larger on request; operating temperatures — liner 500° F, jacket 650° F; operating pressures — tank full vacuum to 25 psi, jacket 65-75 psi (50-60 psi with tank at full vacuum).

..... A subsidiary of A.O.Smith Corporation .....

The World's largest manufacturer of glass-lined steel products

Pump standardization

1 YOUR CHOICE OF MATERIALS OF CONSTRUCTION

All iron

All bronze

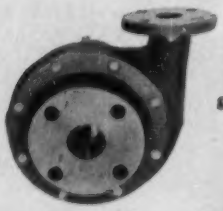
All Worthite

Iron with bronze impeller and trim

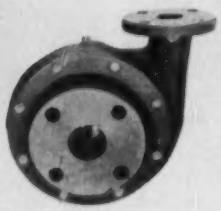
Steel with iron impeller and trim

Steel with bronze impeller and trim

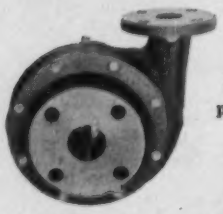
2 YOUR CHOICE OF LIQUID ENDS



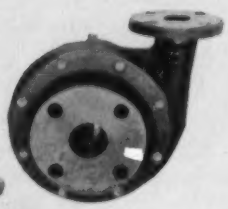
With closed impellers for general service



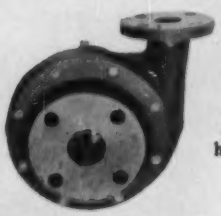
With open impellers for general and abrasive services



With closed impellers for process service



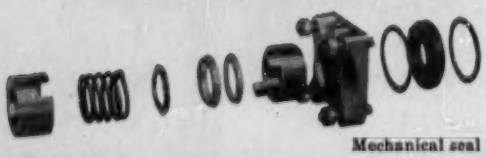
With open impellers for corrosive services



With closed impellers for hotwell service

3 YOUR CHOICE OF SHAFT SEALING METHODS

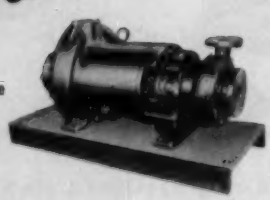
Stuffing box



Mechanical seal

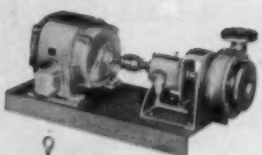
4 YOUR CHOICE OF DRIVES

Monobloc Motor



Monobloc Turbine

CLOSE-COUPLED



Direct Motor Drive

Direct Turbine Drive

Belt Drive

FRAME-MOUNTED

Choose from 70,480 combinations. Worthington's SESC—Standard End Suction Centrifugal—line allows you to "custom-build" your pump from stock parts. In each of the 120 sizes, you have a choice of materials of construction, types of liquid ends, shaft sealing methods, and drives. Because the SESC line is built from standard, stocked parts, you get prompt delivery at competitive prices.

slashes inventory, reduces downtime, cuts maintenance

...yet gives you 70,480 combinations to choose from

STANDARDIZE AND SAVE! NOT SOMETIME IN THE FUTURE, BUT NOW!

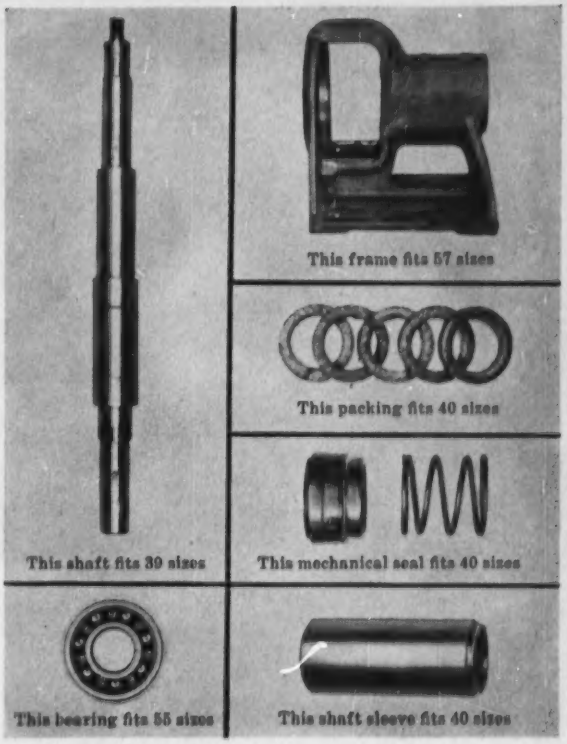
With Worthington's SESC–Standard End Suction Centrifugal–line, you can cut your warehousing and inventory costs as much as 50%, greatly simplify pump maintenance, and reduce downtime.

You get these benefits *without* sacrificing flexibility. In fact, the SESC line gives you an even broader selection. Because *parts* have been standardized and not *pumps* you can literally "custom-build" your pump to get exactly the right features for your particular application.

The complete Worthington SESC pump line consists of six separate types, all suitable for either motor, turbine, or belt drive. Ratings range up to 2700 GPM and 230 ft. head. Pumps and spare parts are available from field stock in all strategic areas as well as from the factory.

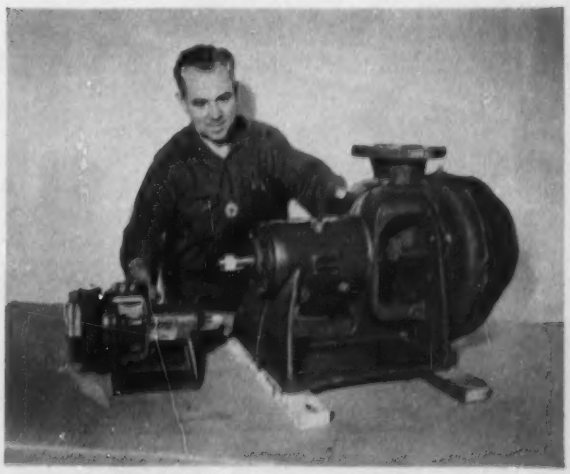
If you'd like to know more about the SESC line, write to Section PC61, Worthington Corporation, Harrison, N.J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont. PC.6.1

WORTHINGTON


This frame fits 57 sizes
This packing fits 40 sizes
This shaft fits 39 sizes
This mechanical seal fits 40 sizes
This bearing fits 55 sizes
This shaft sleeve fits 40 sizes

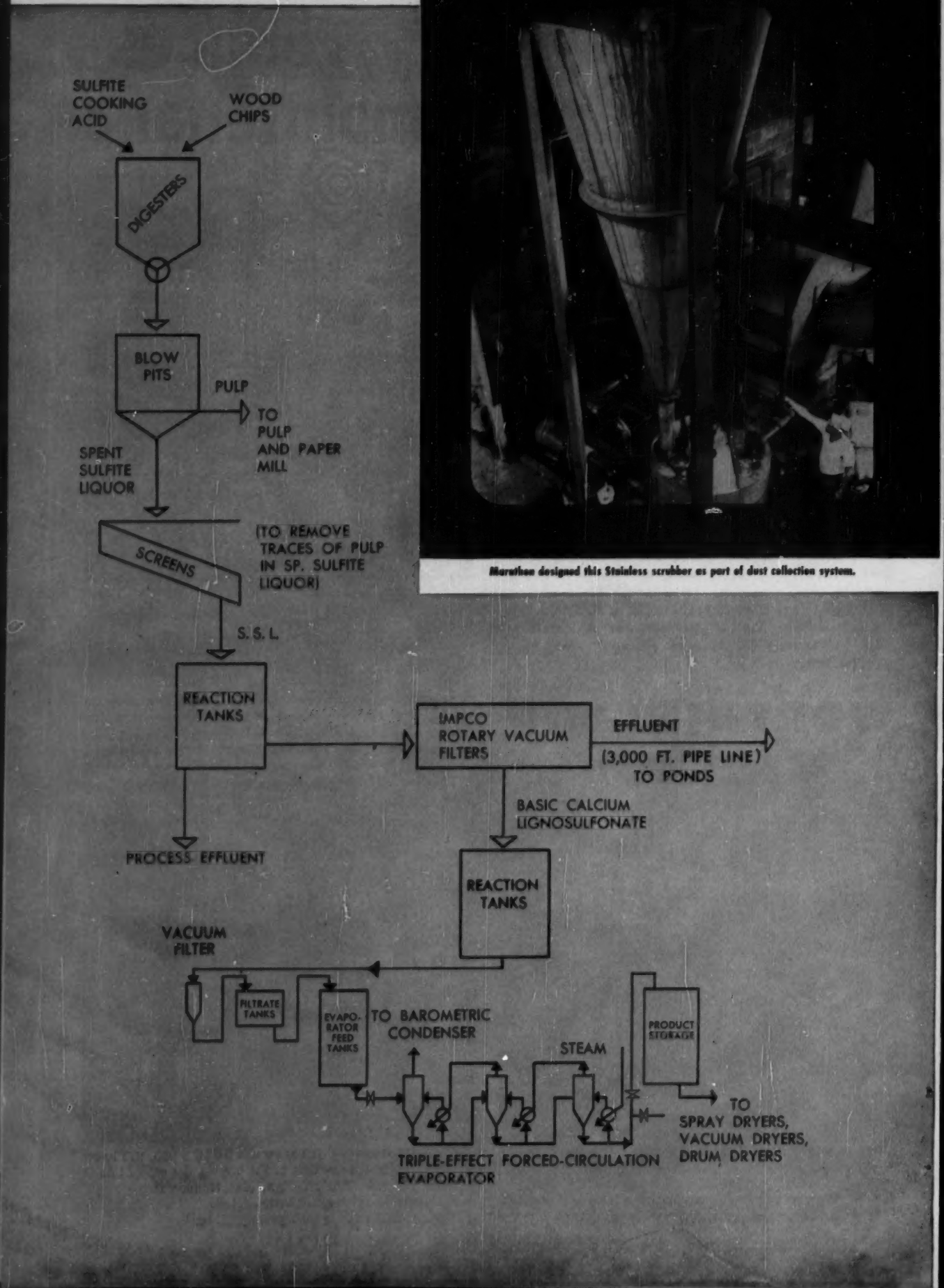
Slashes parts inventory. You can cut inventory costs as much as 50% by standardizing on the SESC–Standard End Suction Centrifugal–line. In the 120 sizes in the complete line, many, many parts are interchangeable. As shown here, one shaft is used in 39 sizes, one bearing in 55 sizes, one frame in 57, one packing in 40, one mechanical seal in 40, and one shaft sleeve in 40 sizes.

Reduces downtime. Parts interchangeability can mean big savings. When repairs or conversions are necessary, standardization can often drastically cut downtime. For example, all SESC pumps can quickly be converted from packed stuffing box to mechanical seal and vice versa using *stock* parts.



Cuts maintenance. If you know one SESC pump, you know them all. From the smallest to the largest the entire line is built to the same basic design. Maintenance men quickly become familiar with construction details. Their work is simplified and maintenance costs greatly reduced.

Marathon designed this Stainless scrubber as part of dust collection system.



Stainless Steel stacks vent corrosive liquid from dryers.

Operator checks controls on Stainless Steel evaporator.

How sulfite liquor waste is turned into profit with the help of Stainless Steel

At its sulfite mill in Rothschild, Wis., the Marathon Corporation produces more than 50,000 tons of cellulose fibers per year. In the 1920's, Marathon started an intensive research program aimed at reducing river pollution from the spent sulfite liquor and recovering the 50% wastage of organic solids that resulted.

By fractionating the sulfite liquor, valuable lignosulfonates could be produced; but it was strictly a laboratory operation because the highly acid liquor corroded all normal materials—until Stainless Steel became available in the early 1930's.

Since it was completed in 1936, the new plant processes *all* the effluent from the Rothschild plant; and it has a capacity of 75 million pounds a year. It is the only plant in the world completely devoted to the production of fractionated lignosulfonates and *approximately 50% of the equipment is made from Stainless Steel.* This includes thousands of feet of 6-inch tubing, storage tanks, rotary vacuum filters, evaporators and dryers. Much of the Stainless is type 304 or 316. And much of it has been in continuous service for 15 years, compared to previous materials that disintegrated after 18 *months.*

When designing new process equipment, frequently nothing will save more money than the careful use of long-life Stainless Steel. For service-tested quality, specify USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS • STRIP • PLATES • BARS • BILLETS • PIPE • TUBES • WIRE • SPECIAL SECTIONS

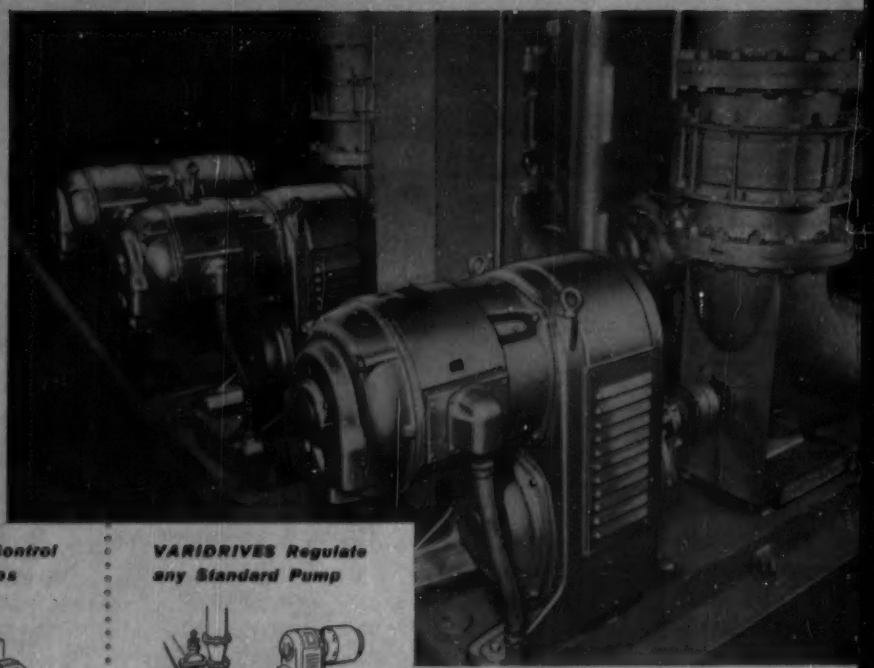
UNITED STATES STEEL

VARIABLE SPEEDS FOR VARYING NEEDS

Control Pumping with U.S. VARIDRIVES

Regulating the High and Low of Sewage Flow with U.S. VARIDRIVES

Thirty-two 20 h.p. U. S. Varidrive motors like these shown increase or decrease necessary pumping action of axial flow pumps which transfer sewage at the new Hyperion Sewage Disposal Plant of the City of Los Angeles. This is another example of the versatility of U.S. Varidrive motors to handle variable speed pumping problems in all types of industry. Varidrives are available from ¼ to 60 h.p. Speeds 2 to 10,000 rpm.



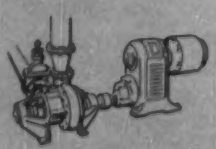
VARIDRIVES Power Pumps used for Pumping Beverages

High pressure, low volume rotary positive displacement pumps used in food plants have a variety of uses with the help of variable speed.

VARIDRIVES Control Metering Pumps

Piston type, positive displacement pumps used for proportioning or metering liquids are often regulated by Varidrives.

VARIDRIVES Regulate any Standard Pump



Centrifugal pumps are made more versatile in handling many different pumping conditions with variable-speed drives.

Versatile VARIDRIVE for Additional Applications

- CONVEYORS
- PUNCH PRESSES
- LATHES
- EXTRUDERS
- PACKAGING
- SPOOLING
- MIXING & BLENDING
- CANNING
- GRINDING
- VENTILATION
- BUFFING

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MOTORS

U. S. Electrical Motors Inc. CE-7
P. O. Box 2058, Los Angeles 54, Calif. or Milford, Conn.
☐ Send U. S. Varidrive Bulletin #1797

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MAIL COUPON NOW

How to Control Heat in a Large Oven

No. 4 of a series — *Showing the Broad Application Range of Fenwal Controls*

The oven is designed to dry 30 yards of finished goods per minute at oven temperatures up to 400°F. The problem was to maintain the desired 330°F in the oven. Here's how this was accomplished —

The many electric heaters, which are distributed uniformly in the oven, provide a total heat input of about 60,000 watts and are divided into two separate control circuits. About one-third of the heaters are controlled by a simple on-off controller of moderate sensitivity to maintain a basic heat level in the oven. The remaining heaters are operated by the Fenwal Series 560 Portable Temperature Indicating Controller, an instrument of high sensitivity and rugged construction. The Series 560 provides the proportioned heat necessary for accurate control of the curing process. It also can be used for straight on-off control. Here's the way the control set-up works —

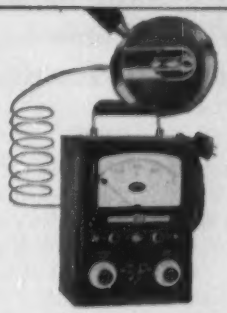
To maintain the desired 330°F in the oven, the on-off controller is set at 315°F, while the proportioning controller is set at 330°F. So both heater circuits are on during oven warm-up or when incoming fabric depresses the oven temperature below 315°F. Above 315°F, the on-off controller shuts off the heaters in its circuit, and the process heat is obtained from the remaining heaters under the control of the Fenwal Series 560 Controller.

THIS 600 CUBIC FOOT CURING OVEN, planned and installed by Atlas Textile Machinery Co., Paterson, N. J. at the Gsell Textile Printing Corp. plant in New York, uses the Fenwal Series 560 Portable Temperature Indicating Controller to provide uniform drying conditions within 2 degrees of the set point.

Integrated Sensitivity a Big Advantage in The Series 560

In the Fenwal Series 560 Temperature Indicating Controller the superior thermoelectric qualities of the revolutionary thermistor are used to fullest advantage. The great resistance change of the thermistor in response to temperature change results in extreme sensitivity. It also enables the use of a simple null balance bridge circuit for increased stability. And it permits the use of a standard electric conductor as a connecting wire — *no special wire is required.*

These characteristics have been *integrated* by Fenwal into a rugged, durable instrument which is the first to combine all three major modes of indicating control — on-off, proportional and adjustable differential — *all functioning with high sensitivity at the flip of a switch.*



SERIES 560 INDICATOR CONTROLLER with magnified cutaway view of thermistor probe.

Proved Applications

Fenwal Sales Representatives and Engineers have saved time, trouble and money in all types of plants and laboratories by solving thousands of temperature control and detection problems. Fenwal THERMOSWITCH® units are controlling processes that involve liquids, gases and solids.

Put Fenwal's vast reservoir of technical know-how to work for you. Chances are your problem has already been met and mastered by Fenwal engineers. Write for Catalog No. 500 for complete information.

FENWAL INCORPORATED
167 Pleasant Street
Ashland, Mass.

Please send me your Catalog No. 500. Our specific problem is:.....

.....

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Name.....*Title*.....

Address.....

City.....*Zone*...*State*.....

Fenwal CONTROLS TEMPERATURE . . . *PRECISELY*

STAYNEW

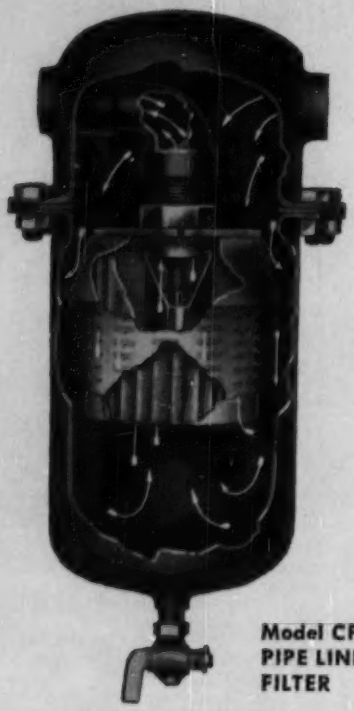
PIPE LINE FILTERS

FOR

CLEAN DRY AIR

IN

- AIR OPERATED INSTRUMENTS
- AIR OPERATED TOOLS
- PNEUMATIC CONTROLS
- INDUSTRIAL PROCESSES



Model CPH PIPE LINE FILTER

MODEL CPH PIPE LINE FILTER has exclusive Staynew "double action principle." Air is first deflected to outer walls of filter and forced downward at high speed. Water, oil and heavier particles of rust, etc., are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter airborne particles. This double action design eliminates need for frequent cleaning.

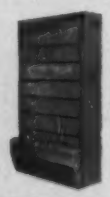
Inexpensive, simple to install and maintain, Staynew Pipe Line Filters keep your air-operated equipment free from the destructive effects of pipe scale, dust, dirt, and condensates. And, Staynew Filters pay for themselves in reduced equipment maintenance costs alone. They filter compressed air under all pressures and temperatures, natural and manufactured gases. Dollinger engineers will welcome your filtration problems. Why not call on us. Remember, Dollinger *makes* every type of filter for every industrial need.

INTAKE FILTERS

LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR



AUTOMATIC AIR FILTERS

PANEL FILTERS

SPECIAL FILTERS

DOLLINGER PROTECTS MOTOR STAYNEW FILTERS

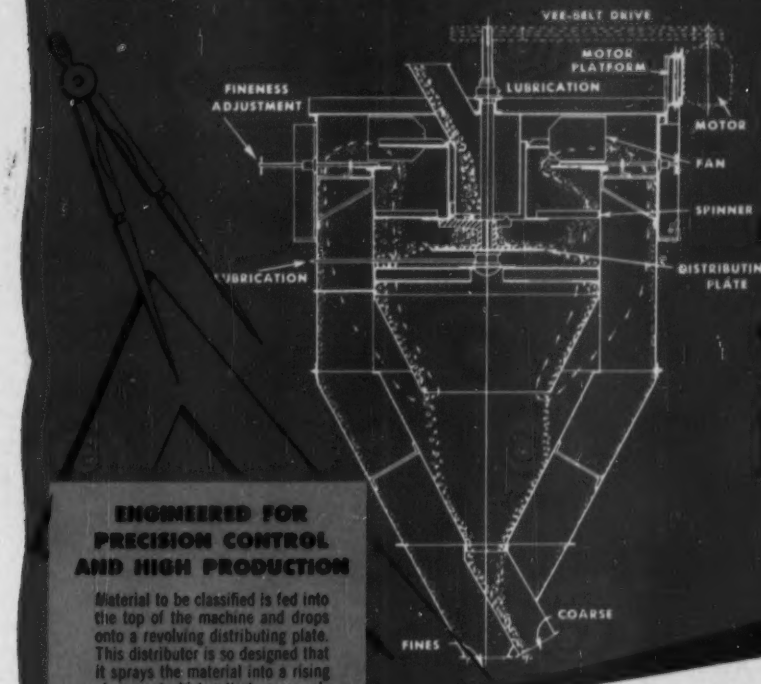
DOLLINGER

CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Write for Bulletin 200 which contains complete engineering data and illustrated material on Staynew Pipe Line Filters. Dollinger Corporation, Dept. 554, Centre Park, Rochester 3, N. Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

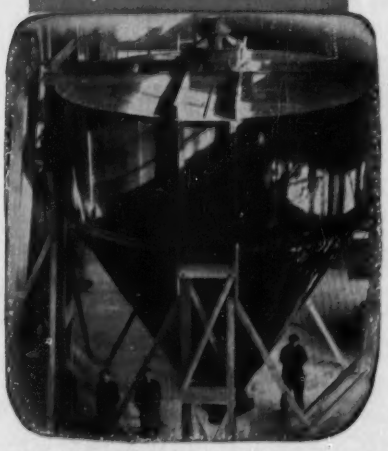


More Accurate Sizing Of Ground And Pulverized Materials!

ENGINEERED FOR PRECISION CONTROL AND HIGH PRODUCTION

Material to be classified is fed into the top of the machine and drops onto a revolving distributing plate. This distributor is so designed that it sprays the material into a rising air current which entirely surrounds the plate. The finer particles are lifted by the air stream and the coarse particles drop down to the reject spout. Passing up through the separating chamber, the dust-laden air is given a whirling motion between Spinner blades and any remaining oversize particles are precipitated. The separator is adjustable to control the fineness of the finished product with unusual accuracy.

WILLIAMS MECHANICAL AIR SEPARATORS For Finenesses From 30 to 325 Mesh



18-Foot Williams RC Separator being tested at plant before shipment.

- Most efficient mechanical air separator ever developed for classifying ground and pulverized materials, or for removing fines from dry ground materials before classifying.
- Product quality is vastly improved and output considerably increased when operated in closed circuit with virtually any type of mill.
- Will handle with equal efficiency a complete range of products—mineral, chemical and vegetable—from the hardest, most dense limestone and ore to the softest, fluffiest starches and flours.
- Permits coarser settings in grinding equipment thus lengthening equipment life by reducing wear on all moving parts. Power consumption is much lower.
- Extra heavy construction. Equipped with anti-friction bearings encased in dust-proof and moisture-proof housings. All casings are of heavy steel plate construction. Operation is dustless and repair cost is practically nil, since there are no fine sieves to wear out and the heavy construction insures long life.

9 Standard sizes, 2½ to 18-foot diameters — Capacities from 500 lbs. to 75 tons hourly

Write For Details And Describe Your Operation

WILLIAMS PATENT CRUSHER & PULVERIZER CO.

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WILLIAMS

CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

HOW *HERCULES* HELPS...

CONSISTENCY, FIRMNESS AND STABILITY, important characteristics not only for toothpaste but for many pharmaceuticals, cosmetics, and other preparations, can be obtained with purified Hercules® cellulose gum. An unusually effective water-binder, Hercules cellulose gum has exceptionally high purity (99.5+%) and meets the specifications of the Toilet Goods Association.

FROM SHIPPING CONTAINERS to individual packages, Hercules paper making chemicals play an important role in improving performance. Kymene® wet-strength resin, for example, can "weather-proof" corrugated boxes while Aquapel® or one of Hercules' many grades of rosin size provide water resistance and an improved printing surface. Solving difficult paper sizing problems has been a Hercules specialty for more than forty years.

PLASTIC-COATED DUPLEX WIRE is used in this type of electric blasting cap assembly. The insulation has to be particularly tough since the wire assembly is used to lower charges of explosives into blast holes 100 feet or more in depth. The plastic coating on these wires is Hercules Hercocel® E, providing excellent insulating properties, good flexibility, and other physical characteristics to meet rugged field requirements.

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INCORPORATED
952 Market St., Wilmington 99, Del. Sales Offices in Principal Cities

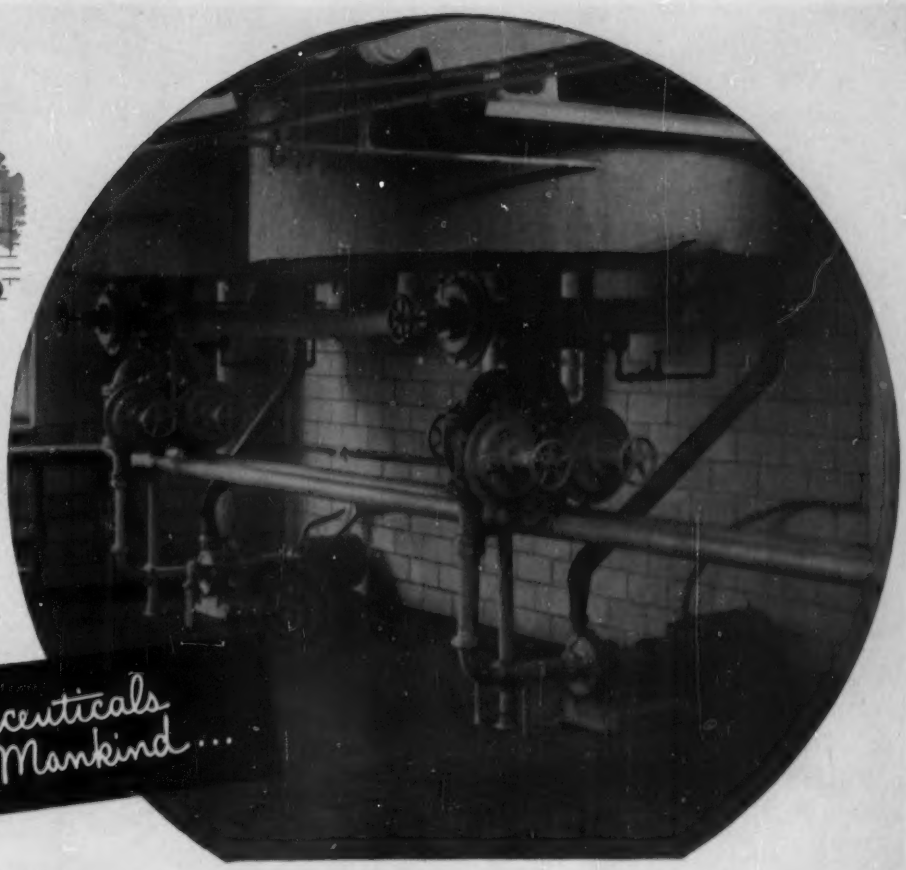
SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS

090-2

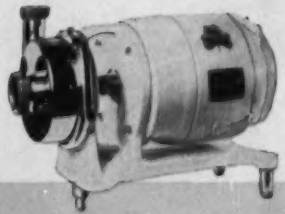
HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

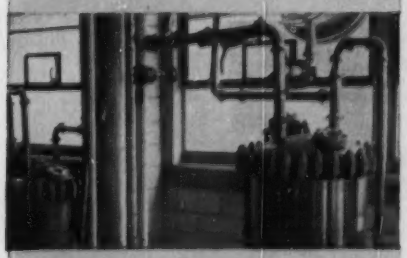
(Right): Tri-Clover stainless steel pumps handle an important liquid conveying job in this pharmaceutical plant.



...produced with TRI-CLOVER Pumps, Fittings and Valves



One of a complete line of Centrifugal Pumps designed by Tri-Clover. Full details on these modern, efficient units are contained in the complete Tri-Clover Sanitary Pump Catalog 253. Write for your copy.



Both standard acme thread and Tri-Clamp stainless steel fittings and valves are utilized in these liquid process lines.

The scenes depicted here show some of the Tri-Clover pumps and stainless steel fittings and valves now being used by a modern midwest pharmaceutical plant. Tri-Clover supplies the vital elements necessary to provide a "streamlined" processing line with the greatest possible degree of corrosion-resistance and sanitation. This is a typical example of the way Tri-Clover products are used to help solve numerous liquid conveying line and pumping problems for the chemical process industries.

For pumping applications, Tri-Clover supplies corrosion-resistant centrifugal pumps designed to handle, efficiently and economically, any product that will flow to them. For process lines, Tri-Clover fittings and valves are widely used to assure the utmost protection against corrosion and product contamination.

Take advantage of Tri-Clover's exclusive features developed through many years of specialized engineering experience and thorough understanding of liquid conveying problems.

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Tri-Clover Division
Kenosha Wisconsin

See your nearest Tri-Clover Distributor.

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Basic Idea

SOLVES MANY REDUCER MOUNTING PROBLEMS

FOOTE BROS. NEW

Line-O-Motor Drive

One base supports both speed reducer and motor in this simple, practical and foolproof mounting system . . . Now you can use standard N.E.M.A. motors and make change-overs in minutes—reducing both costly down-time and motor inventory.

Line-O-Power motorized drive solves many old problems . . . and opens new fields of advanced design for new applications. Available 1-75 H. P. for all Service Classes—Horizontal, Vertical, and Vertical Extended with Foot or Flange mounting—Double or Triple Reduction units available in Ratios from 5.06:1 to 238:1.

FOOTE BROS.

Better Power Transmission Through Better Gears

4545 S. WESTERN BLVD., CHICAGO 9, ILLINOIS

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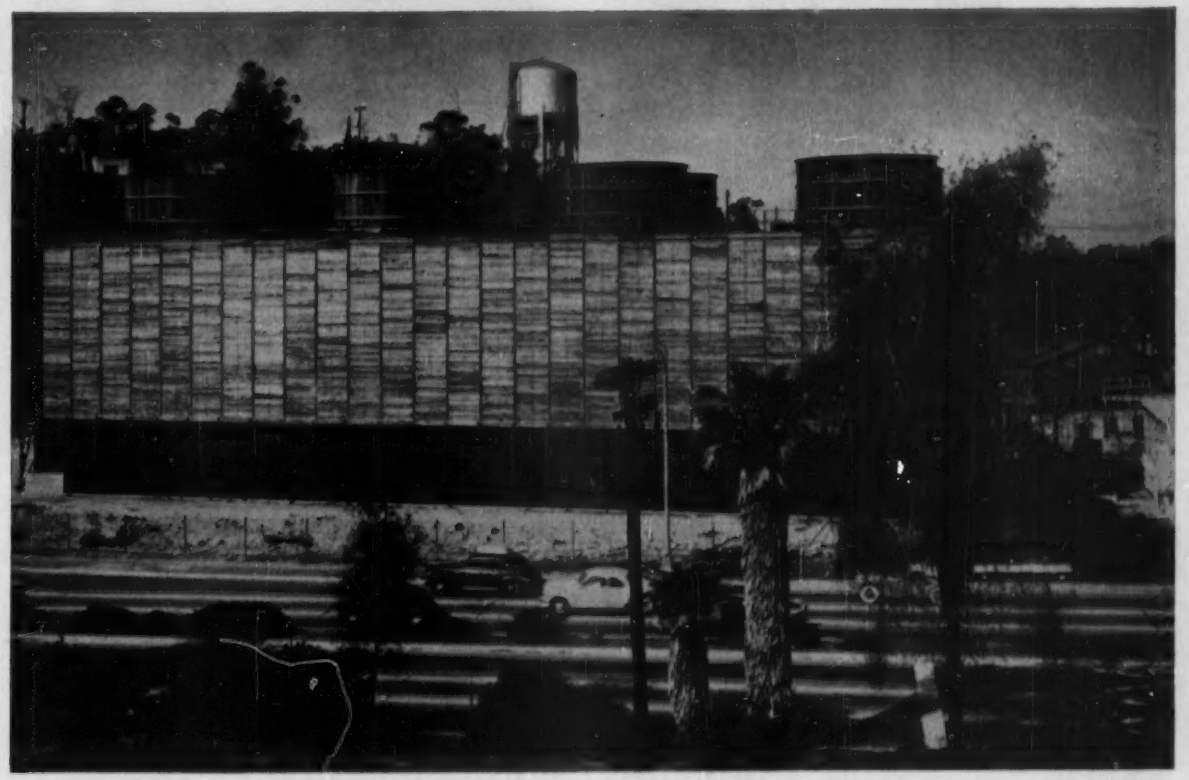
Write for your Line-O-Motor Catalog today

COOLING TOWER
Eliminates Highway Fogging Problem



Careful Custom-Engineered Design eliminates driving hazard on one of Southern California's main traffic arteries

THE Municipal Light and Power Department of the City of Pasadena, California, faced a serious problem in locating cooling towers within 25 feet of the Arroyo Seco Freeway at their Broadway Steam Plant.

Although the vapors from a cooling tower contain nothing but pure water and do not *pollute* the atmosphere, "fogging" of the Freeway could not be tolerated as a driving hazard.

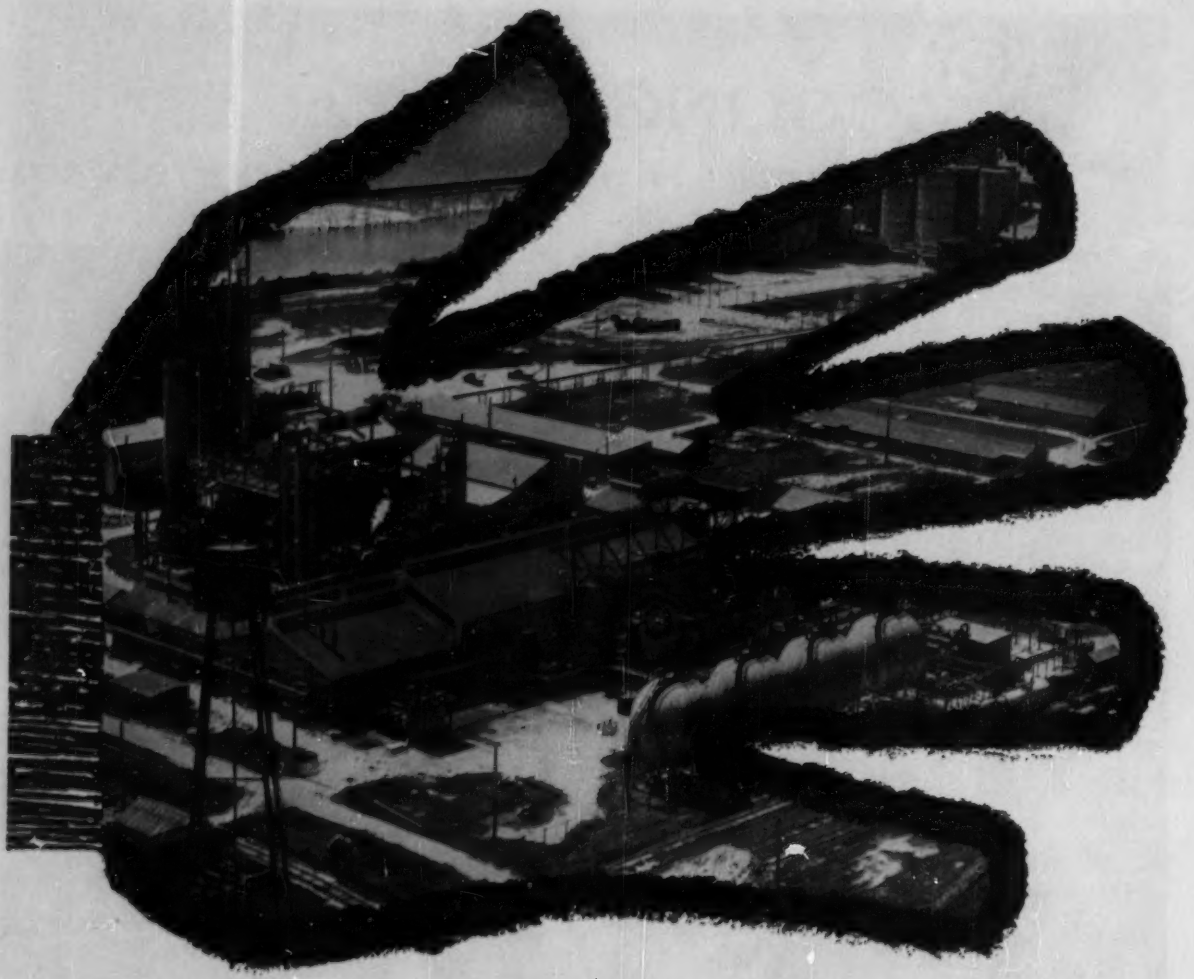
The Foster Wheeler eight-cell cooling tower shown above, installed in 1954, has successfully met this challenge. Freedom from "fogging" of the Freeway was achieved by proper drift-eliminator design, correctly engineered exit vapor velocities, and the use of *moderately* high fan stacks extending 12 ft. above the fan deck and 55 ft. above the basin curb.

Complete satisfaction with this initial FW Cooling Tower has now been proved by the City's recent re-order of a duplicate FW Tower to be located down the property line adjacent to the Freeway.

THIS NEW BULLETIN describes the *new* Foster Wheeler induced-draft, counter-flow cooling tower — every detail designed for long-range dependability and economy. Send for your copy today. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.



Handling Caustics and Alkalis?
Prevent Contamination with

ALCOPLATE*

A chemically deposited nickel plate

In applications where caustics and alkalis are handled, they can be protected with ALCOPLATE against contamination from pipe, valves, pumps and vessels. ALCOPLATE reduces the danger of iron pickup to a minimum, and also resists corrosion of process equipment.

ALCOPLATE can be applied to parts with intricate shapes. It provides a continuous non-porous plating of uniform thickness and eliminates the need for expensive machining of costly metals. Hardness is 45 Rockwell C and can be increased to 70 Rockwell C through post-plate heat treatment. Corrosion resistance? In nearly all applications, ALCOPLATE is equal to or better than pure or wrought nickel.

To prevent contamination and insure long life for your process equipment, call your nearest ALCO representative. He has complete information on ALCOPLATE performance in specific services. Or write P.O. Box 1065, Schenectady 1, N. Y.

*ALCOPLATE – Trade-mark registration applied for. An application of "Kanigen" a mark identifying the chemical deposition of high-nickel, low-phosphorus alloy by General American Transportation Corporation and its licensees and the coating resulting therefrom – on license from General American Transportation Corporation.

ALCO

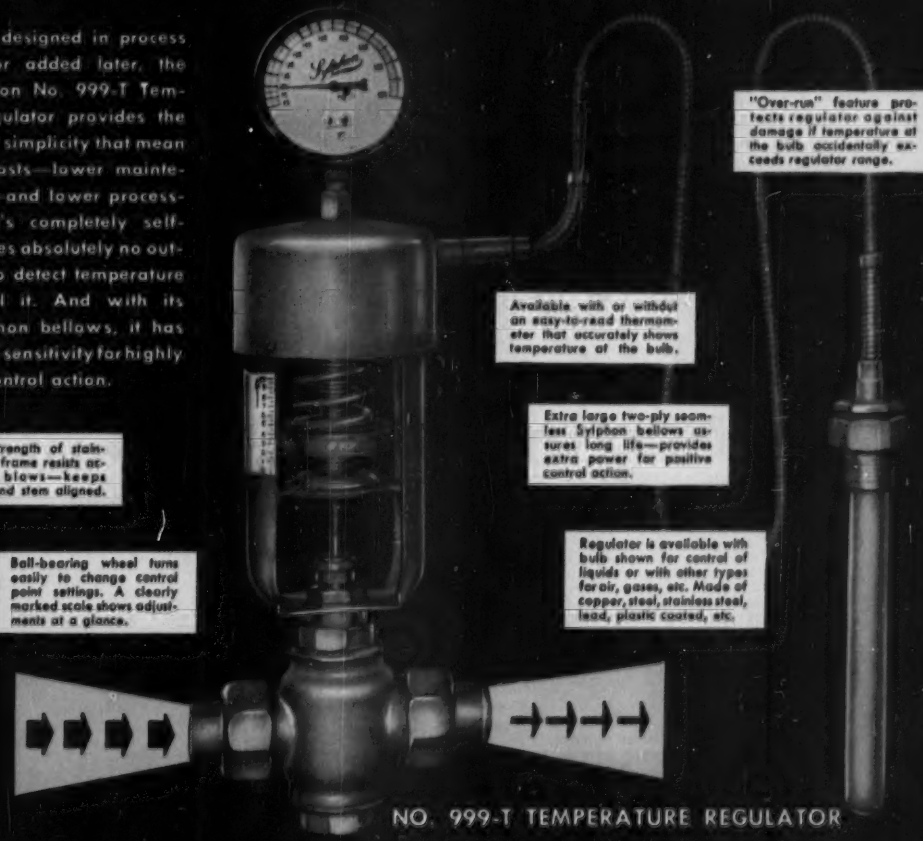
ALCO PRODUCTS, INC.,
New York

FULTON SYLPHON TEMPERATURE REGULATOR HEADQUARTERS, U.S.A.

CONTROLS TEMPERATURE
UNDER ITS OWN POWER

COMPLETE LINE OF REGULATORS, VALVES, MIXERS, AND CONTROLS FOR LIQUIDS, AIR OR GASES.

Whether it's designed in process equipment or added later, the Fulton Sylphon No. 999-T Temperature Regulator provides the accuracy and simplicity that mean lower first costs—lower maintenance costs—and lower processing costs. It's completely self-contained, uses absolutely no outside power to detect temperature or to control it. And with its famous Sylphon bellows, it has the power and sensitivity for highly responsive control action.



"Over-run" feature protects regulator against damage if temperature at the bulb accidentally exceeds regulator range.

Available with or without an easy-to-read thermometer that accurately shows temperature of the bulb.

Extra large two-ply seamless Sylphon bellows assures long life—provides extra power for positive control action.

Added strength of stainless steel frame resists accidental blows—keeps bellows and stem aligned.

Ball-bearing wheel turns easily to change control point settings. A clearly marked scale shows adjustments at a glance.

Regulator is available with bulb shown for control of liquids or with other types for air, gases, etc. Made of copper, steel, stainless steel, lead, plastic coated, etc.

NO. 999-T TEMPERATURE REGULATOR

Available with 60 F ranges between 20° and 455 F.
Variety of valve types in sizes from ¼" to 4".

Mr. Controls

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION
Knoxville 1, Tenn.

Robertshaw-Fulton Controls Co.
FULTON SYLPHON DIVISION
Knoxville 1, Tenn.

☐ Send literature on Temperature Regulators for Industrial Processes, Catalog D-NC

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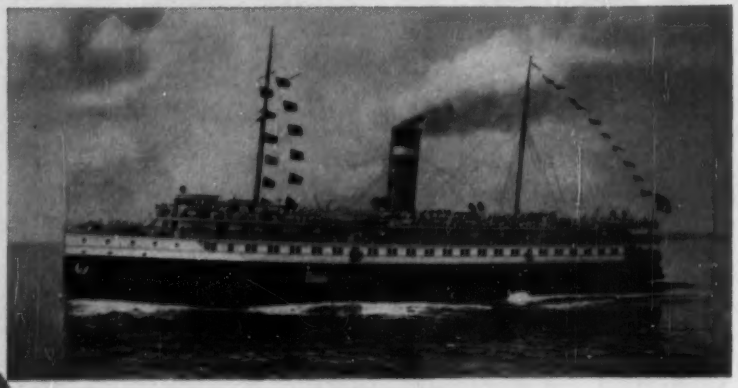
BETHLEHEM

AMERICA'S LEADING SHIPBUILDER-MANUFACTURER OF

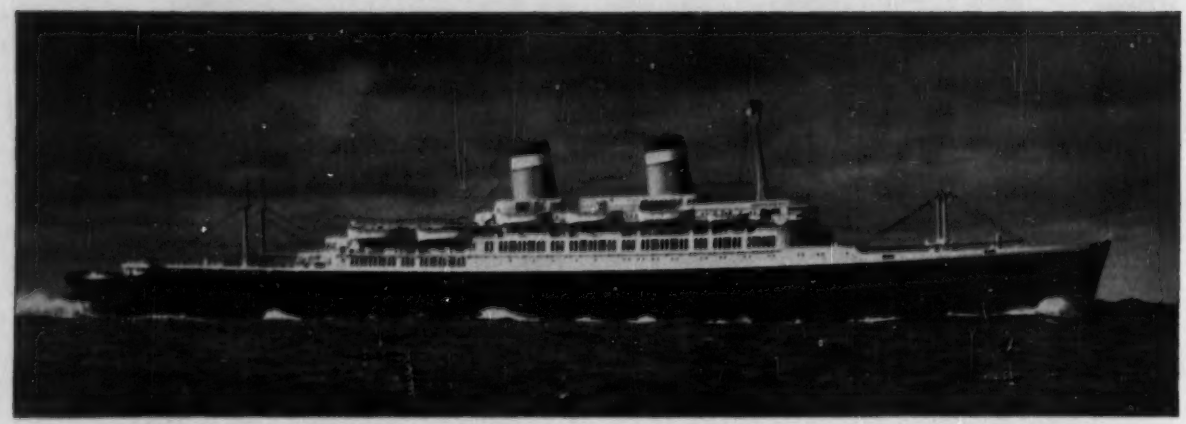
MARINE TURBINES

Turbines for the *S.S. Governor Cobb*, at right, first commercial ship in the United States to employ this form of propulsion, were built in 1906 by what is now Bethlehem's Hoboken Yard. For 41 years, until she was scrapped, the original turbines propelled this vessel through a varied career, including service as a U. S. Coast Guard helicopter carrier.



50 YEARS

of Marine Turbine Building



Turbines for the Bethlehem-built-and-engined *S.S. Independence*, above, and her sister-ship, *S.S. Constitution*, are lineal descendants of the *Governor Cobb's* engines and incorporate the accumulated research and experience of almost half a century. Thus, they may be expected to have a similarly long and dependable life.

Internationally recognized for efficiency, dependability and ruggedness, Bethlehem-built turbines always are integrated with the design of the ship and carry the warranty of the world's foremost steelmaking and shipbuilding organization. Furthermore, Bethlehem's shipyards can service these turbines speedily because of their intimate knowledge of these engines and the quick availability of parts and spares. From every standpoint, a good combination *all ways* is the Bethlehem-Built-and-Turbined ship.

SHIP REPAIR YARDS

Boston Harbor — New York Harbor
Baltimore Harbor — Beaumont, Texas
Los Angeles Harbor — San Francisco Harbor

SHIPBUILDING YARDS

Quincy, Mass. — Staten Island, N. Y.
Sparrows Point, Md. — Beaumont, Texas
Terminal Island, Calif. — San Francisco, Calif.

BETHLEHEM STEEL

Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

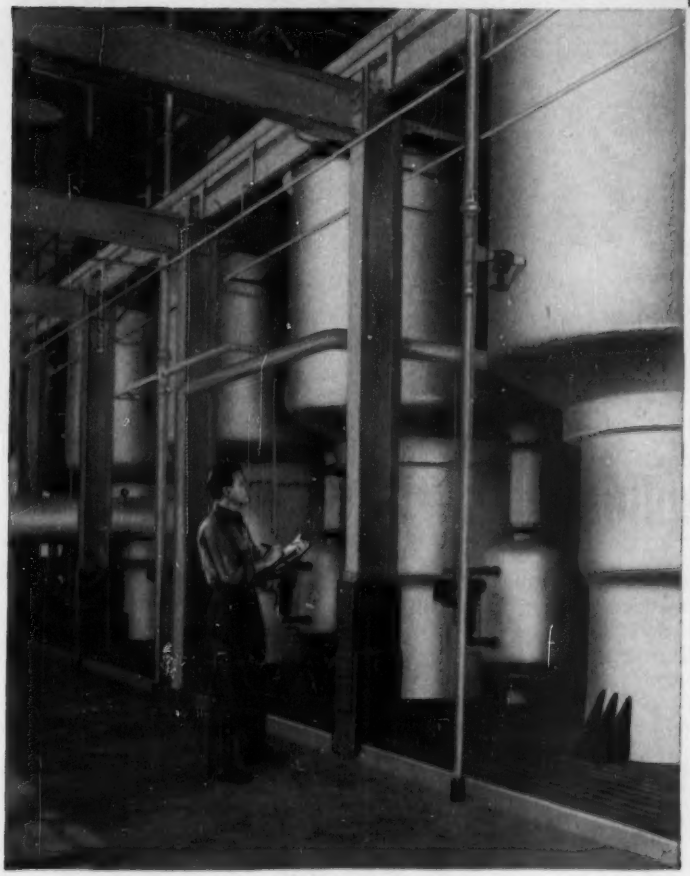
On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation

...ANOTHER RESULT OF IMPROVED PROCESSING

SWENSON EVAPORATORS

help produce better sugar...

at lower costs



Refiners of beet sugar are experiencing new success through an improved method of processing—Swenson Multiple-Effect Evaporation. Swenson high-velocity LTV pressure evaporators are generating essentially all of the process vapors used in modern beet sugar factories. Heat economies of approximately 500,000 BTU per bag of sugar are being obtained. Food, chemical, pharmaceutical—almost every type processing industry—has profited substantially from Swenson Evaporation equipment. The reason: Swenson Evaporators can improve product quality while lowering production costs. *Your* product could be next. The surest way to find out is to talk with a Swenson engineer. Call or write today.

SWENSON EVAPORATOR CO.

15669 Lathrop Avenue, Harvey, Illinois

SWENSON

Proved Engineering for the Process Industries

Since 1889

Evaporators

Spray Dryers

Crystallizers

Filters

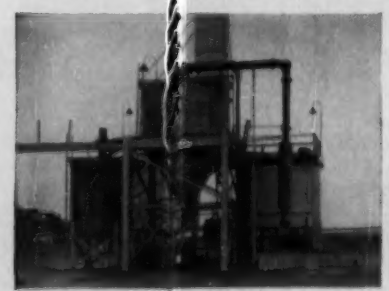
A Division of WHITING Corporation

Better flavor, better health in every bite**. . . thanks, in part, to Monel.

New table salt supplies vital "trace" nutrients

Made directly from sea water in Monel-protected equipment

Nearly everyone is familiar with the use of iodine to prevent goiter . . . fluorine to stop tooth decay . . . iron to overcome anemia.



Heat and motion complicate salt corrosion problem in evaporator (elevated) and slurry (left) tanks at Trace Element Corp. plant. Monel protects both tanks and their interior processing equipment as well.

Experts now say other elements in trace quantities may prove equally vital to health. Copper, cobalt, magnesium, manganese, zinc, molybdenum and others.

A new type of salt—"Admiral" Trace Element Sea Salt contains these "micronutrients." Prepared for table and cooking use, it can supply them pleasantly in called-for quantities.

Hence an interesting new plant 35 miles south of Corpus Christi, Texas. Here, Trace Elements Corporation produces free flowing table salt containing 75% NaCl and 25% other minerals from sea water.

Avoids equipment corrosion problems

In designing the new plant, engineers faced two potentially serious corrosion problems... attack on interior surfaces of equipment by the highly saline stream . . . and attack on exterior surfaces of equipment by salt-laden offshore breezes.

Use of Monel* nickel-copper alloy in the more critical pieces of the plant's equipment avoids both hazards. Monel alloy is used for the evaporator tank and its submerged combustion unit . . . for slurry tank, mixer shaft and impeller blades . . . for surfaces in contact with salt in the rotary dryer and cyclone dust collector . . . for all pump impeller housings . . . and other items.

If corrosion by salts is troublesome to you, Monel, nickel, or one of the other nickel alloys may cut your problem down to size. To look into the matter, simply write:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL ALLOYS

Monel... for minimum maintenance

*Registered trademark

**For more information on Trace Element Sea Salt, write Trace Elements Corporation, 718 N. Drennan St., Houston, Texas.

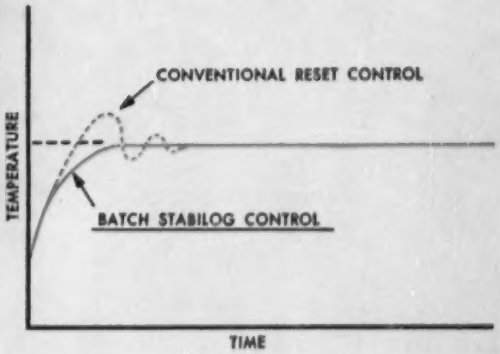
Faster, safer start-ups for Batch Processes

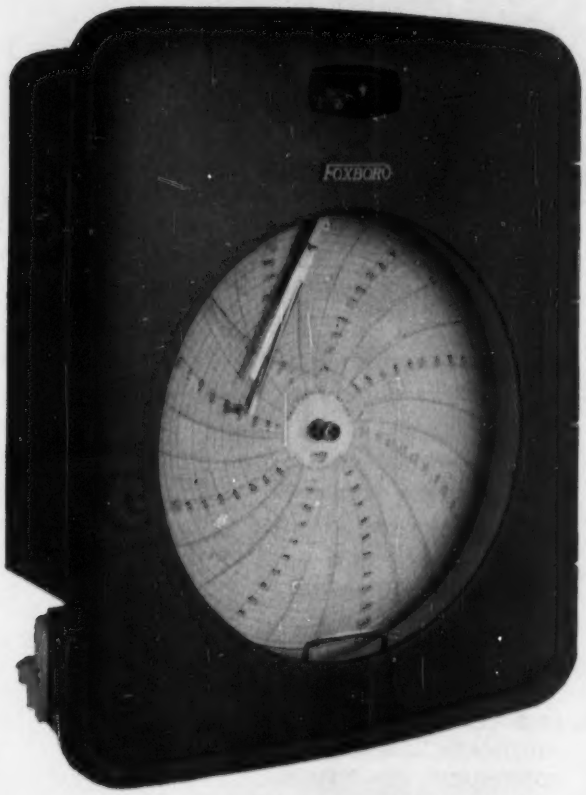
no overshoot

no spoilage

no undesirable side-chain reactions

no explosion hazards





That's right! You can get rid of costly, dangerous temperature "overshoot" problems in batch processing! The Foxboro Batching Controller solves them. This versatile Controller brings temperature up to control point fast . . . stops it "on the nose" . . . keeps it there throughout the holding period. What's more, this fast "no overshoot" control doesn't compromise *holding* control . . . settings are made separately, for optimum results in both periods.

Here's how the Controller works. It starts the operating cycle by feeding maximum heat to the batch . . . brings temperature up fast. At desired distance below control point, adjustable "braking" action automatically slows temperature rise . . . levels it off smoothly at the control point. Simultaneously, the "balancing" action begins . . . holds control point setting exact . . . restores it even when upsets occur. At shut-down of process, the Controller automatically resets itself . . . ready for another precise performance.

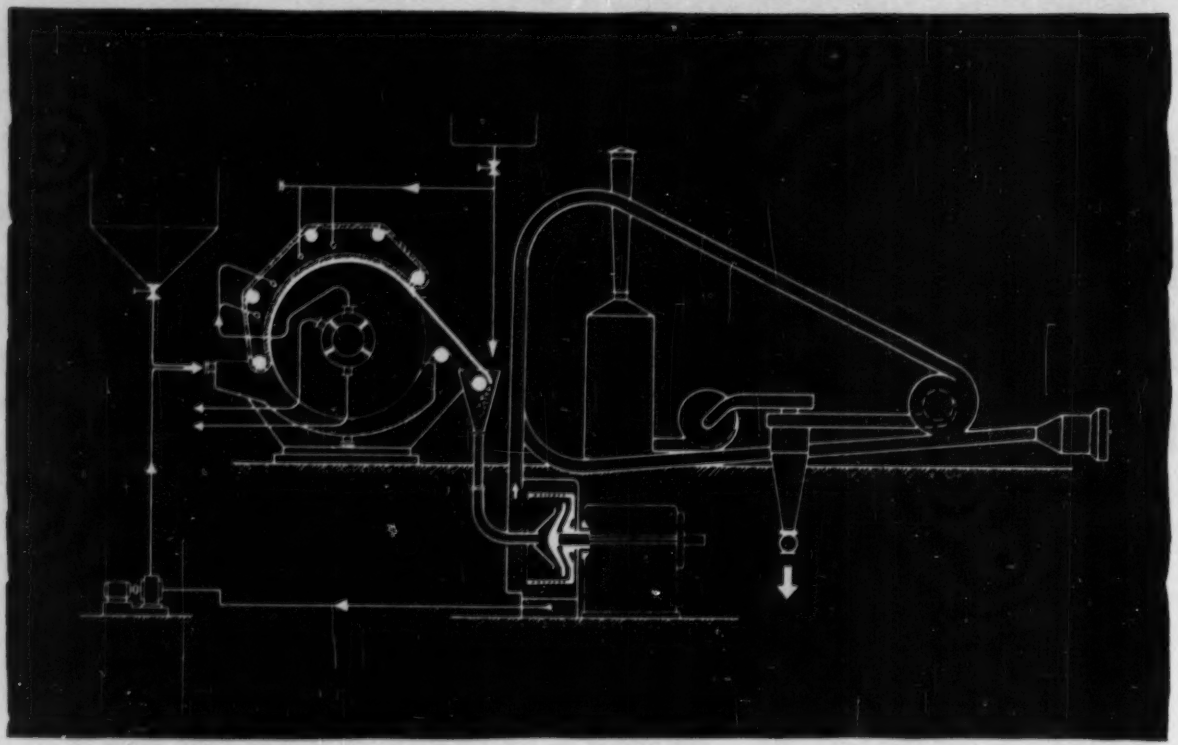
Send for information today. (For batch operations requiring *controlled rate of rise*, write for data on Foxboro Cam-Set and Time-Cycle Controllers.)
The Foxboro Company, 367 Neponset Ave., Foxboro, Mass., U.S.A.

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

FOXBORO
REG. U. S. PAT. OFF.

CREATIVE INSTRUMENTATION for Process Automation

IMPERIAL SOLVES SEPARATION PROBLEMS



Rotary Filter with washing **Continuous Centrifuge** **Thermal Finish Dryer**

Here is an example of a fully continuous plant utilizing our equipment. The advantages of such a combined plant are:

- Intense counter-current washing
- Maximum degree of separation
- Clear filtrate
- No conveyor equipment
- No storage tanks
- Quick thermal drying
- Lower labor and operating costs
- Faster amortization

Other Separation Problems are solved by one single machine of our production range

IMPERIAL IN SEPARATION

with: FEED CONDITIONERS
AUTOMATIC CENTRIFUGES
CONTINUOUS CENTRIFUGES
CONTINUOUS ROTARY FILTERS
WACO-FILTERS
DRYERS OF VARIOUS DESIGNS
COMPLETE PULP MILLS

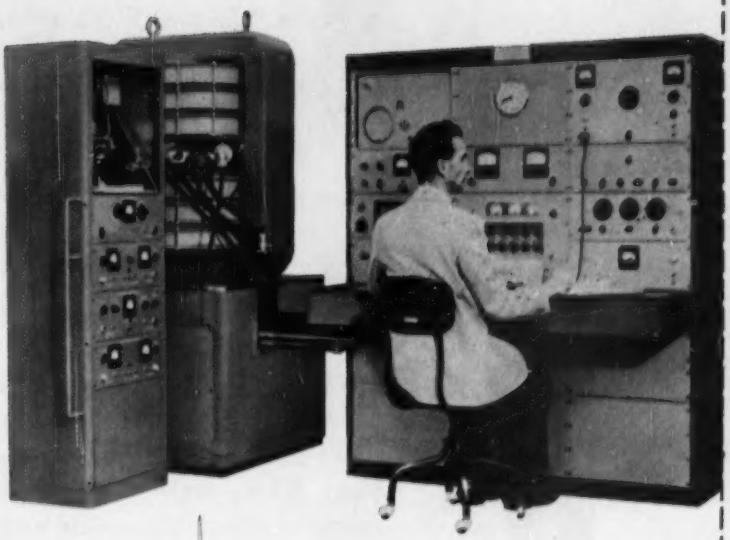
Write for Bulletins. Ask for nearest Representative.

KRAUSS-MAFFEI-IMPERIAL

MUNICH, GERMANY

FAST ANALYSES FOR A FAST AGE

Consolidated's 21-103C Mass Spectrometer for Jet-Fuel Research . . . Production



Records from the 21-103C are permanent, easy to interpret. They are made automatically, so that the operator can prepare the next sample while one is being analyzed.

Here is an instrument that literally counts molecules to provide one of today's fastest methods for analyzing hydrocarbon gases and liquids. Because it can quickly, accurately determine mixture components at mass numbers as high as 700, yet be equally at home with gases and light liquids, the 21-103C has proved invaluable in every phase of the growing jet-fuel business. It is used in process research to perfect new refining methods . . . in process control to insure production efficiency and product quality . . . and in the jet-engine business itself for fuel and exhaust-gas analyses in research and development studies of combustion efficiency.

The 21-103C Mass Spectrometer is *fast:* only an hour or less to analyze even complex mixtures . . . key-component determinations in just minutes. Up to 30 or more components can be separately determined, and a permanent, easily read record is made automatically for every analysis. Where accelerated research and production programs demand fast methods . . . *and top accuracy* . . . it will pay you to investigate this thoroughly proven, thoroughly up-to-date instrument. Send for Bulletin CEC 1800C-X20.

HERE'S WHAT THE 21-103C MASS SPECTROMETER CAN DO . . .

exploratory analyses . . . *every* volatile material in the sample registered, its presence made known, whether or not it is expected.

control analyses . . . feed, intermediate, or product streams quickly analyzed, for maintaining optimum process efficiency and uniformly high product quality.

purity determinations . . . can detect contaminating substances present in concentrations as low as 5 parts per million.

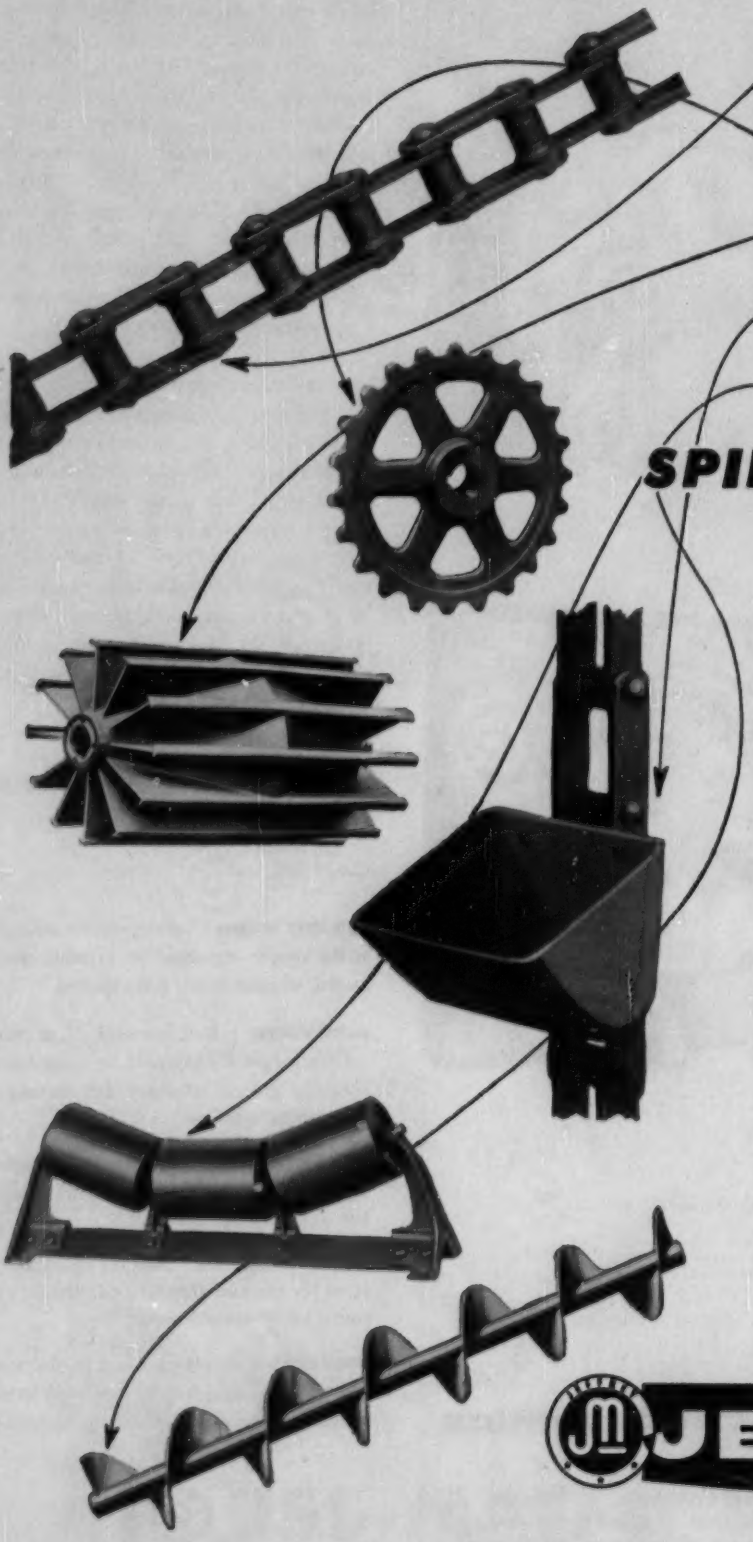
research investigations . . . flexible operation is ideal for the non-standard conditions encountered in research work.

complex-mixture analyses . . . 30 or more components in mixtures can be separately determined; even mass isomers readily separated.

Consolidated Electrodynamics
CORPORATION
formerly Consolidated Engineering Corporation
300 North Sierra Madre Villa, Pasadena, California
SALES AND SERVICE OFFICES IN: *Albuquerque, Atlanta, Boston, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, San Francisco, Seattle, Washington, D.C.*

Electronic Instruments for Measurement and Control

Specify **JEFFREY** when you replace



CHAINS
SPROCKETS
PULLEYS
BUCKETS
IDLERS
SPIRAL FLIGHTS

YOUR Jeffrey distributor can supply the units you need for replacing worn parts and modernizing old equipment. Your materials-handling and power-transmission machinery will give more efficient, economical operation when you use these time-tested, dependable products.

Jeffrey replacement parts have the same sound design as those used on original equipment. All are designed for maximum service. Materials and workmanship are the finest. Jeffrey District Offices and Distributors are located in all principal cities. The Jeffrey Manufacturing Co., Columbus 16, Ohio.

JEFFREY

CONVEYING · PROCESSING · MINING EQUIPMENT · TRANSMISSION MACHINERY · CONTRACT MANUFACTURING

Quaker State Reports: *Kemp Dryer protects instrument lines from freezing at temperatures of 25° below zero*

Instrument failure is now a rare thing at the Quaker State Refining Corp., Farmers Valley, Pa. Quaker State installed a Kemp 300-E Oriad Dryer in December, 1954, and according to Process Supervisor Joe Brown it has really done a job safeguarding instrument operation.

Kemp Saves Time, Labor

The company no longer has to steam trace or insulate instrument air lines. A longer period of time can be allowed between servicing instruments. Even at temperatures of 25° below zero, none of the lines froze. And to further save time and manpower, the dryer is fully automatic! Between its "elimination of instrument failure and ease of operation," Kemp earned its place on the Quaker State team.

Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air, gases or liquids to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now. For complete facts and technical information, write for Bulletin D-27.

KEMP OF BALTIMORE

DYNAMIC DRYERS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • INERT GAS GENERATORS
SINGEING EQUIPMENT

THE C. M. KEMP MFG. CO.
405 East Oliver Street, Baltimore 2, Maryland

NEW!

BUFFALO "BLH"

FOR CLASS II THRU IV VENTILATING-INDUSTRIAL & MECHANICAL DRAFT SERVICE

THE NEW "Buffalo" Type "BLH" FAN is engineered for installations where total pressure requirements of 3¾" and up exist. These applications include mechanical draft, conduit air conditioning and many industrial applications.

CANTILEVERED INLET VANES eliminate center ring, reducing turbulence and improving air flow through the inlet. The die-formed inlet vanes and inlet bell further contribute to smooth air flow, minimizing effects of unfavorable inlet conditions.

THE PROVEN BL WHEEL has a deep drawn flange to form a true half-circle with the inlet cone. Highly efficient non-overloading backward-curved blades, solid back plate and extra heavy hub make this wheel ideally suited to this service.

IMPROVED FAN OUTLET — reduces outlet air turbulence from fan cutoff into duct by making more even, gradual change from velocity to static pressure. Without this complete streamlining of inlet, housing AND outlet, such high efficiency is impossible.

Smooth Divergent Flow

86% MECHANICAL EFFICIENCY — made possible by a combination of inlet, wheel and housing design. The smoothest "air-ride" in fan history.

"Buffalo" "Q" FACTOR* CONSTRUCTION gives you many years of trouble-free service. Housing is all-welded construction. Wheel and blades are riveted and welded for maximum strength, the basic design having been thoroughly tested in the Vacuum Pit, a "Buffalo" exclusive.

AVAILABLE in wheel diameters from 18¼" to 80¾", the new "Buffalo" "BLH" merits your consideration. Write for details on your company letterhead — today.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

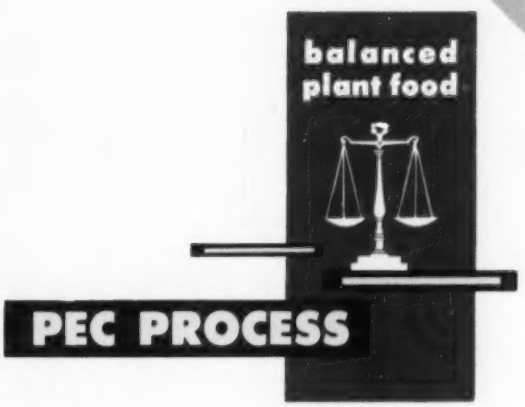
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

complex fertilizer

C&I



Nitric Acid
Phosphoric Acid
Ammonium Nitrate-Stengel Granular
Ammonium Nitrate-Stengel Spherical
Ammonium Nitrate-Prilled
Complex Fertilizer
Ammonium Phosphate

THE CHEMICAL AND INDUSTRIAL CORP.
CINCINNATI 26, OHIO

C&I

Designers and Builders of Plants for the Processing of Ammonia. Available Throughout the World

announcing

a new line of **small-size easy-to-read** gauges and receivers

NEW **REPUBLIC V5 GAUGES**

Individual, Independent Measuring Units for
DRAFT • PRESSURE AND VACUUM • DIFFERENTIAL PRESSURE • TEMPERATURE
High Accuracy Receivers for Pnuematic Transmitters and Electric Meters Measuring
FLOW • PRESSURE • CO_2 • DENSITY • LIQUID LEVEL • OTHER PROCESS VARIABLES

Important Features

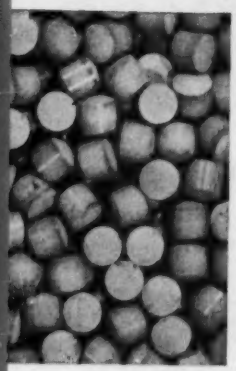
- FIVE INCH ILLUMINATED SCALES
- INDEPENDENT, INTERCHANGEABLE UNITS
- MULTIPLE OR INDIVIDUAL MOUNTING — from one to eight units to a single case
- EASILY MOUNTED — no panel drilling necessary in most cases
- SCALES EASILY CHANGED OR COLOR-CODED
- POINTER MOTION REVERSIBLE
- SIMPLIFIED CONNECTIONS AT BACK OF CASE
- REMOVAL FROM FRONT OR BACK

Now you don't have to sacrifice instrument performance and readability to size considerations. With Republic's new line of small-size V5 Gauges, you can save panel space, make more compact instrument groupings and *still* get the accuracy, sensitivity and readability you would expect from conventional sized instruments. Full sized diaphragms, bellows and helix units in V5 Gauges assure "big" gauge performance in an instrument that requires only one-fourth the panel space of conventional gauges. Five inch scales are almost flat and are indirectly illuminated as a standard feature for easy reading — even from a distance.

• ***Write for New V5 Bulletin*** ▶

REPUBLIC FLOW METERS CO.

2240 Diversey Pkwy., Chicago 47, Illinois

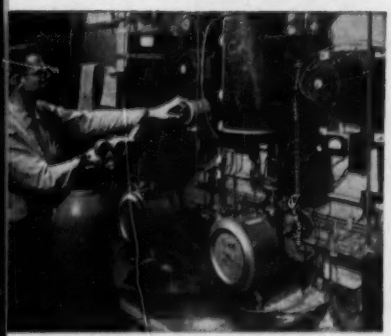


Plus values of Girdler Catalysts

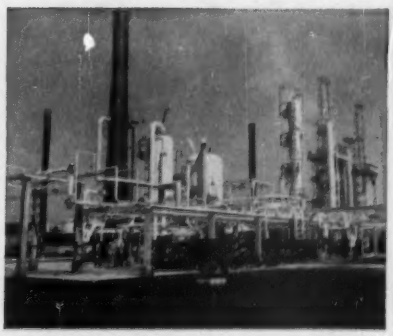
APPLICATION SERVICE
DEVELOPMENT SERVICE
ANALYTICAL SERVICE
MARKET SERVICE
ADVANCED PRODUCTION

A full-scope catalyst service to improve your processing

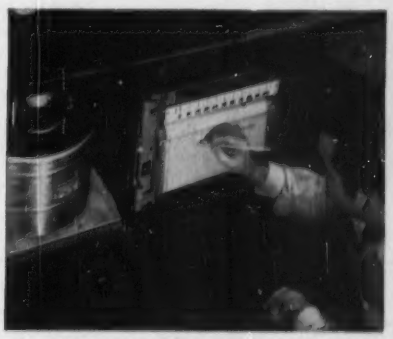
KEYSTONE of Girdler's co-ordinated catalyst testing work is its development service. Here, highly-skilled technicians work with modern laboratory equipment (like this pilot type autoclave) to create new catalysts and improve existing ones. Girdler's full-scope catalyst service is helping many processors in a wide range of applications boost production and lower costs. Find out how it can work for you to your advantage.



MARKET RESEARCH specialists investigate customer's specific problems and create catalysts to meet their specific needs. They also help develop new end products and improve quality, made possible through better catalysts.



FIELD SERVICE fully complements Girdler's broad catalyst research activities. Girdler's trained specialists work closely with customers at their plants—make sure they get the best possible results from Girdler Catalysts.



FINEST QUALITY and peak performance of Girdler catalysts is assured by our Analytical Service. This vital branch not only monitors our production, but also does valuable "trouble-shooting" analytical work when Girdler customers encounter problems.

CATALYST DEPARTMENT

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

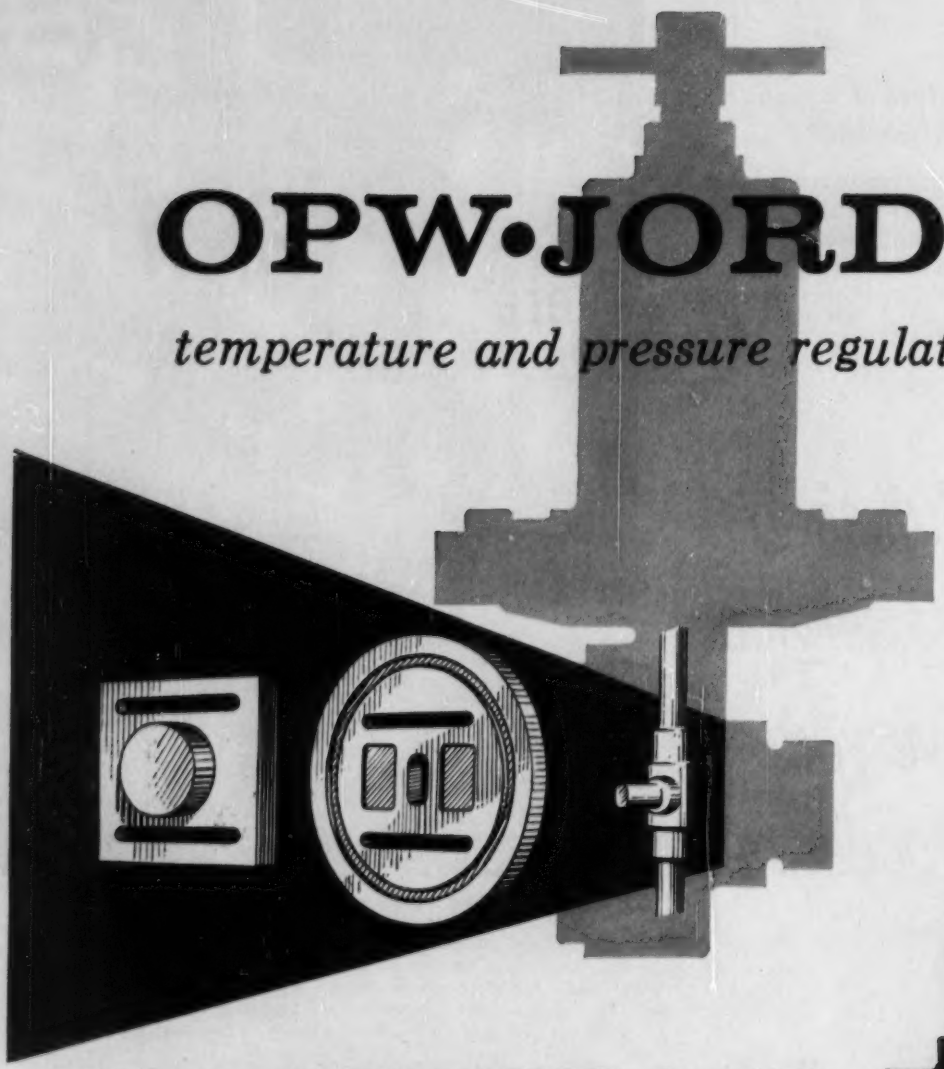
LOUISVILLE 1, KENTUCKY

GAS PROCESSES DIVISION: New York, San Francisco **VOTATOR DIVISION:** New York • Atlanta • Chicago • San Francisco

In Canada: Girdler Corporation of Canada Limited, Toronto

OPW•JORDAN

temperature and pressure regulator valves



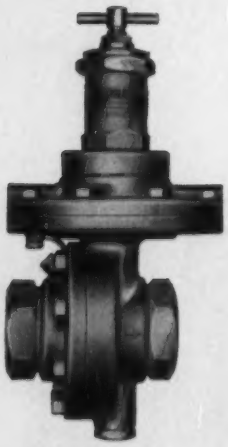
with the patented **SLIDING GATE***

*the heart of the OPW-Jordan Valve specifically designed to overcome wire drawing, valve leakage, poor control, chatter, excessive maintenance.

Unusual sensitivity, dead end shut-off, close control, self-lapping action. Metallic diaphragm—no lubrication necessary.

Investigate all of the advantages of OPW-JORDAN SLIDING GATE. Superior in design and performance!

**JORDAN's Trade Mark for its variable orifice plate seating construction.*



NO. 1160 PILOT OPERATED PRESSURE REDUCING VALVE

Recommended for critical control applications requiring unusually sensitive and accurate regulation . . . and extreme pressure reductions. Performance not affected by wide variations of inlet pressures. No external downstream tap necessary; all seals metal to metal.

Write for Bulletin J-1160

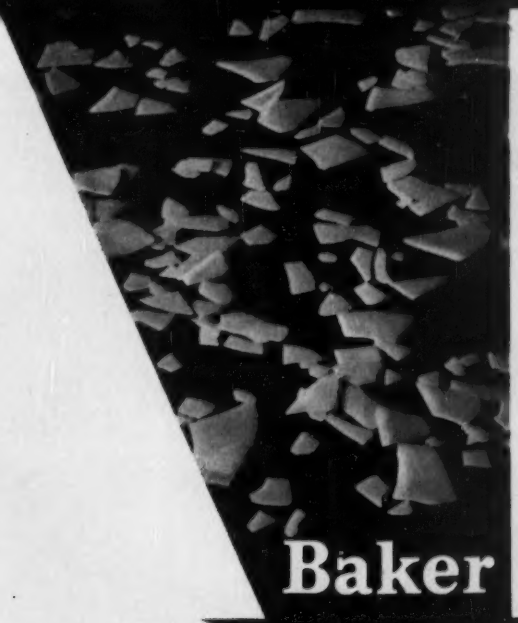
JORDAN CORPORATION

DIVISION OF OPW CORPORATION

6013 Wiehe Road
Cincinnati 13, Ohio
Elmhurst 1-1352

Representatives in principal cities.

OTHER OPW-JORDAN PRODUCTS: SELF CONTAINED DIRECT ACTING PRESSURE REDUCING VALVE • DIAPHRAGM MOTOR VALVE FOR REMOTE CONTROL, RELIEF AND BACK PRESSURE • SELF-OPERATING TEMPERATURE CONTROL VALVE • PACKLESS SELF-CLOSING SLIDING GATE SAMPLING VALVE • TEMPERATURE CONTROL MIXING VALVES FOR WATER TEMPERATURE REGULATION



Here's news!

Baker CALCIUM NITRATE, Tech.
ZINC NITRATE, Tech.

in THIN FLAT FLAKES

- *Faster dissolving*
- *Uniform purity—lot after lot*
- *Controlled water of hydration*
- *Easier to handle*

Look over the photograph above, reproduced to actual size. Note the thin flakes with large surface area. THIN FLAKES go into solution FAST – you save time and money. They are easy to handle. These chemicals in *flake* form represent another Baker first.

Latex processors gain better control of coagulation because of the controlled high assay and known water of hydration. This uniform purity, controlled pH and freedom from extraneous matter insure better quality in your finished goods with fewer rejects.

These chemicals are produced to meet precise specifications. In the informative typical analysis shown below, note the very low ammonium nitrate content in Baker Calcium Nitrate. The exceptionally low copper and manganese contribute to longer life for your latex products, with less tendency to oxidize and become brittle or too soft.

These features of Baker Calcium Nitrate and Zinc Nitrate also are helpful to manufacturers of rustproofing specialties, textile finishes, pigments, adhesives and lithographic materials.

Because of the low melting points and deliquescent nature of these chemicals, they are packaged with polyethylene liners and are stored in an air conditioned warehouse at a temperature below 85°F.

Write for samples and prices for these new *flaked* products, Calcium and Zinc Nitrate Technical.

CALCIUM NITRATE, Technical Flake — Typical analysis

Assay (as $Ca(NO_3)_2$)	71.8 %
Water of Hydration	27.6 %
Insoluble and NH_4OH Ppt.	0.03 %
Ammonium Nitrate (NH_4NO_3)	0.1 %
Magnesium & Alkalies (as NO_3)	0.4 %
Iron (Fe)	0.0003%
Copper (Cu)	0.0004%
Manganese (Mn)	0.001 %
pH of 5% Solution	6.3

Thin (0.025 in.) flakes about ½ inch in size with the following typical mesh analysis:

On U.S. No. 4	45%
Thru U.S. No. 20	8%

ZINC NITRATE, Technical Flake — Typical analysis

Assay (as $Zn(NO_3)_2$)	74.2 %
Water of Hydration	25.6 %
Insoluble Matter	0.008 %
Iron (Fe)	0.001 %
Lead (Pb)	0.005 %
pH of 5% Solution	5.1

Thin (0.035 in.) flakes about ½ inch in size with the following typical mesh analysis:

On U.S. No. 4	26%
Thru U.S. No. 20	9%

PURITY BY THE TON
–for production use

J. T. Baker Chemical Co.
REAGENT · CHEMICALS · FINE · INDUSTRIAL
Phillipsburg, New Jersey.

It's the Nash!

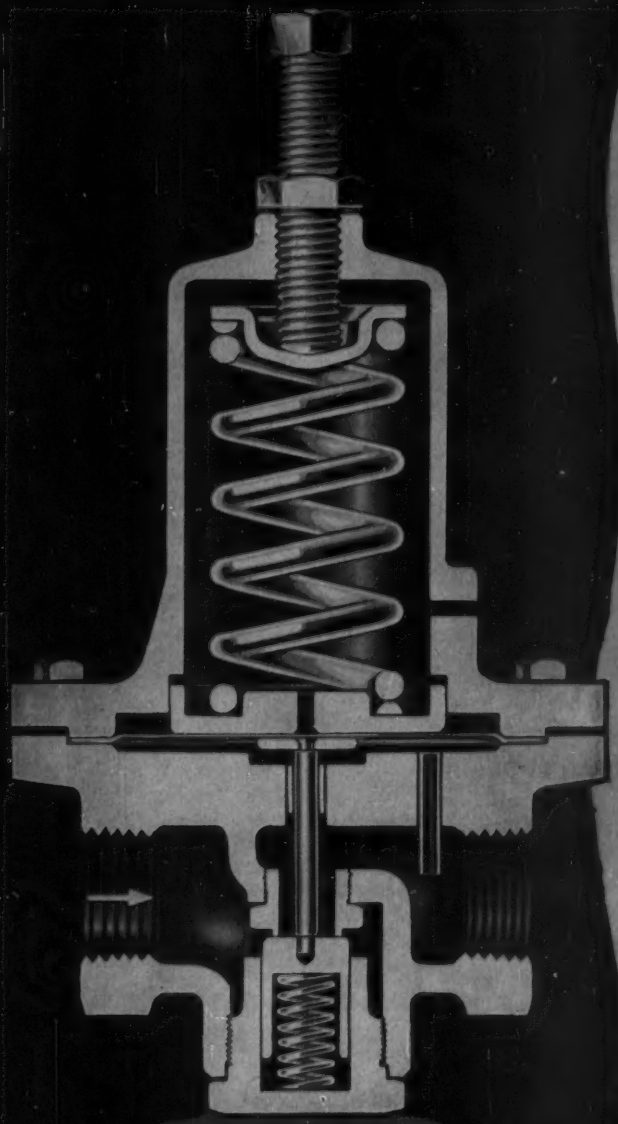
The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature Automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



FISHER®

Series 95

SELF-CONTAINED PRESSURE REGULATOR

. . . A simple, sturdy, self-contained regulator that is suitable for steam, air, gas, oil, water and other fluids.

SERIES 95 features hardened stainless steel trim . . . flat seat . . . machine lapped seating surfaces for tight shut-off for high temperature steam service.

Also available with soft seat construction for low temperature service.

Sizes: ¼", ⅜", ½", ¾", 1". Outlet pressures from 2 to 30 PSI; 15 to 150 PSI.

Size for size, compare its capacity.

Write for Bulletin C-95.

FISHER GOVERNOR COMPANY
Marshalltown, Iowa
Woodstock, Ontario

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER

Since 1880

Nicholson *steam trap* quality *gives you* . . .

extra stamina for severest service

Write, today, for your copy of new Bulletin 10-55—for detailed information.

Nicholson quality . . . throughout . . . means the extra strength, extra capacity, extra stamina that never let down. And, Nicholson quality pays off, when it comes to discharging condensate and air from chemical processing steam lines and equipment . . . most efficiently, dependably, economically.

- **powerful valve action—big husky bellows.**
- **positive shut-off—finely ground valve and seat.**
- **high capacity—effective use of large orifice.**
- **each unit service tested—with steam.**

When less than the best won't do, specify Nicholson.

NICHOLSON

W. H. NICHOLSON and Company

TRAPS • VALVES • FLOATS • METAL PARTITIONS
LAUNDRY, DRY CLEANING AND PRESSING MACHINERY

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES

US RUBBER EXPANSION JOINTS

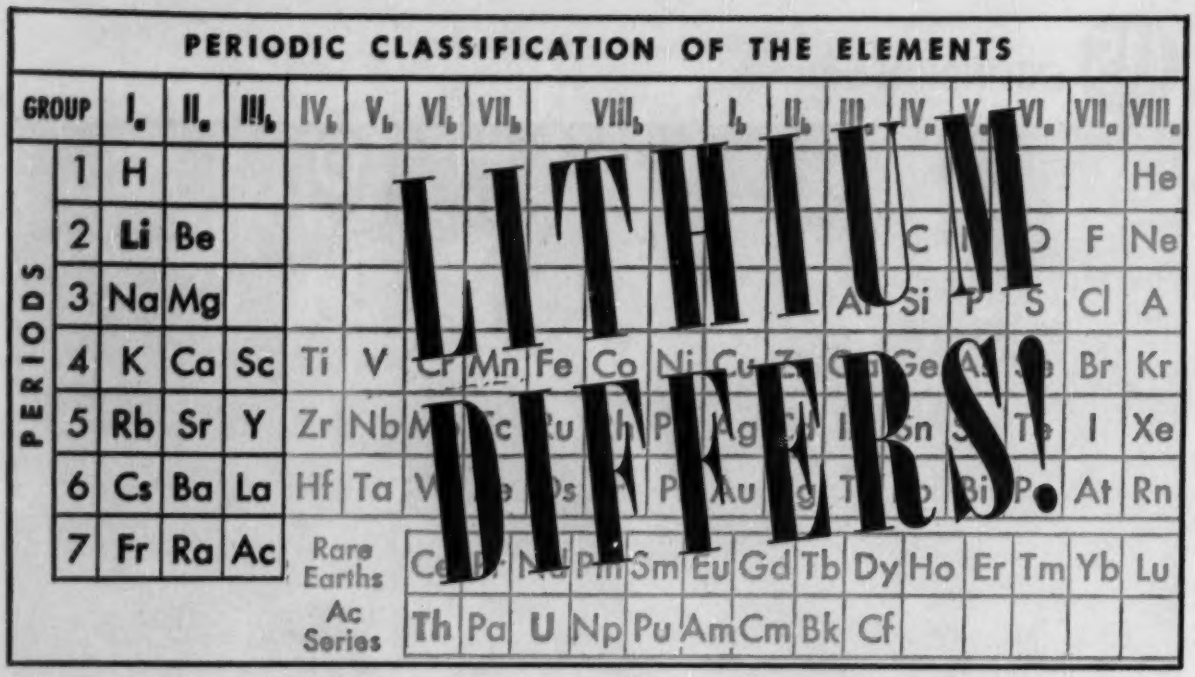
U. S. Rubber Expansion Joints insulate pipe lines against vibration, allow for expansion and contraction—*and* resist corrosion from the outside as well as inside.

These flexible pipe line connections resist attacks by acids, oils, chemicals, and abrasive materials. Even the flanges are rubber faced. And the continuous flexing of the rubber *prevents scale from forming.*

More and more chemical processing plants are turning to U. S. Rubber Expansion Joints because they are not only corrosion resistant, but also extremely durable. There are no moving parts to wear out.

U. S. Rubber Expansion Joints are readily installed on both new and old pipe systems. They are available, along with skilled engineering service, at any of the 28 "U. S." District Sales Offices. Or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER Mechanical Goods Division
United States Rubber



Lithium, by reason of its atomic configuration and general characteristics, is rightfully included as the first member of Group I in the Periodic Table. A detailed study of the properties and reactions of both the elements and their compounds, however, shows that Lithium often resembles the metals of Groups II and III more closely than Group I. Following are some characteristic differences:

Lithium differs in organic chemistry . . .

because its organolithium compounds form a unique class with stability, solubility and activity characteristics intermediate between those of the Group I and Group II organometallic compounds.

Lithium also differs from the other alkali metals in that it serves as a unique catalyst for the polymerization of diolefins to materials of definite and predictable structure. It directs, for example, the polymerization of isoprene predominantly to 1,4 addition structures.

Again, recent investigations have indicated an interesting potential as a direct reducing agent in solvents such as ammonia, low molecular weight amines, and ethylenediamine.

Lithium differs in metallurgy...

inasmuch as the affinity of Lithium for oxygen, for example, is being utilized to reduce porosity in copper and copper alloy castings. Recent research has revealed that Lithium will produce brazing alloys with self-fluxing properties and increase the wetting ability of these alloys.

Lithium differs in inorganic chemistry . . .

the usefulness of Lithium Hydride and Lithium Aluminum Hydride in the preparation of other hydrides having already been widely demonstrated. Recent studies indicate that other complex hydrides prepared in a similar manner may prove to be interesting tools for research. The low dissociation pressure of Lithium Hydride at its melting point, to cite a specific example, is unique among all hydrides. LiH also has some slight solubility in polar organic compounds which is again unique among alkali metals.

Lithium differs in heat transfer . . .

based on its physical properties it has no equal as a liquid metal coolant. Due to corrosion caused at elevated temperatures by impurities in commercially available Lithium and Lithium Metal, Lithium has thus far found only experimental use.

Why don't *you* take a long look at Lithium? Its uniquely valuable differences in so many diverse fields may prove of great interest—and profit—to *you*. Write our PR&D department giving us details of the application you have in mind. Experimental quantities of Lithium Compounds are available on request.

. . . trends ahead in industrial applications for lithium

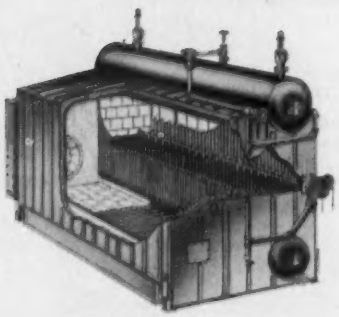
LITHIUM CORPORATION OF AMERICA, INC.
2505 RAND TOWER
MINNEAPOLIS 2, MINN.

MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, North Carolina • Cat Lake, Manitoba • Amos Area, Quebec • BRANCH SALES OFFICES: New York Pittsburgh • Chicago • CHEMICAL PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minnesota

REDUCE YOUR STEAM COSTS THREE WAYS

with the New Foster Wheeler

PACKAGED STEAM GENERATOR



CONSTRUCTION FEATURES

- 36″ steam drum and 24″ water drum
- Staggered boiler tube arrangements
- Closely spaced waterwall tubes
- Water cooled target wall
- No headers — Low circulation loss
- Light, highly efficient refractory and insulation
- Wide choice of burners and controls
- Baffled steam collector

You save on *first cost* because the FW unit is pre-engineered and shop fabricated from standard parts by the most modern, efficient and cost-saving production methods.

You cut *installation cost*, with a compact, space-saving unit that's shipped completely assembled — all ready to set on a simple foundation — all ready for your fuel, steam and electric connections.

You save *operating cost* all year 'round, because FW Packaged Steam Generators are designed for high sustained efficiency and exceptional ease of inspection and maintenance.

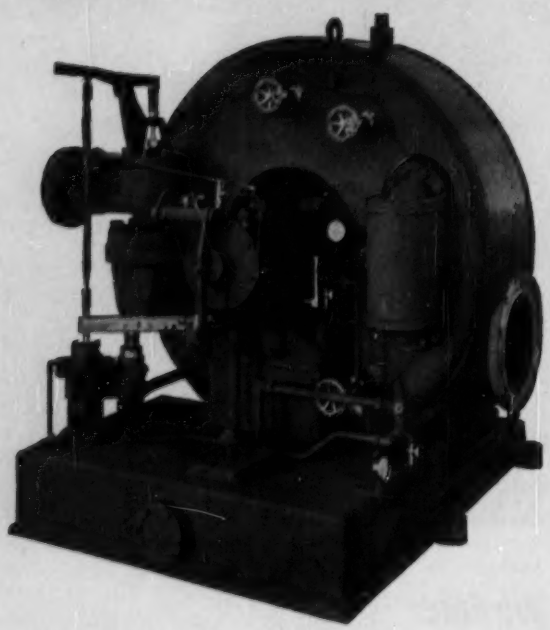
The NEW Foster Wheeler Packaged Steam Generators, in capacities from 10,000 to 46,000 lb/hr, represent the last word in modern steam plant design, reflecting more than 50 years of service to the power generation industry.

For complete details, send for Bulletin No. PG-55-3.
Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

TROUBLE-FREE TURBINE OPERATION STARTS HERE



TT-1200

Terry solid wheel turbines have become a symbol for dependable, trouble-free operation. The reason—simplicity and ruggedness of construction.

Take the rotor, for instance. It's a solid forging in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. Since the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

Simplicity outside too—as you can see from the photograph of the 1500 HP at 3500 RPM solid wheel turbine above. This turbine is equipped with an oil relay governor and forced feed lubrication to the bearings.

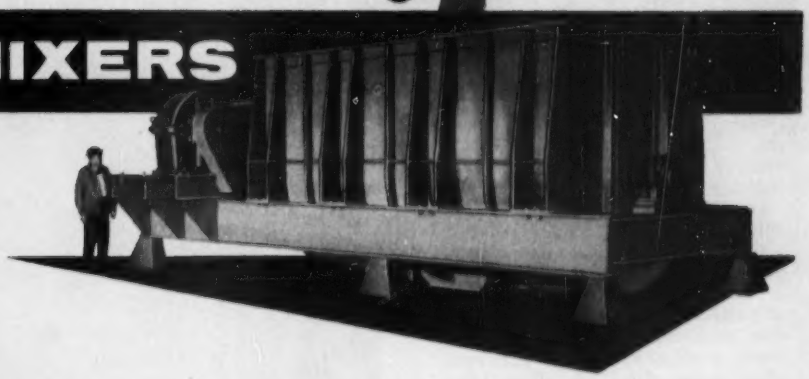
For more about these *work horses of industry*, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

Sprout-Waldron

gives you the Big Plus in MIXERS



Here's one of the largest ribbon-type mixers ever built—a Sprout-Waldron Horizontal Batch Mixer, Style "B". It is ideal for the rapid, intimate mixing of small percentages of a number of critical ingredients with a large bulk of basic material or filler.

Sprout-Waldron also offers the greatest variety of vertical mixers—ranging in size from the world's largest to the world's smallest. They offer big savings in power and space.

Other mixers in the Sprout-Waldron line include machines that convey as well as mix . . . that blend materials to a degree far beyond ordinary mixing . . . that raise and lower temperatures while mixing . . . and that dry damp materials and add liquids to dry materials while mixing.

You get more than a mixer at Sprout-Waldron. You also get reliable guidance, practical suggestions, and new ideas on installations and applications . . . at no extra cost. These are BIG PLUS factors that give you installations without bottlenecks, cut your costs, and help improve the uniformity and quality of your products.

For details, write for free Bulletin 95—an informative treatise on equipment and systems for processing dry and semi-dry materials.

SPROUT-WALDRON

Manufacturing Engineers Since 1866

15 LOGAN ST., MUNCY, PA.

PR/418

FROM START TO FINISH, YOU CAN DEPEND ON SPROUT-WALDRON

UNICHROME

News about

COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

New plastisol sprays extra-thick coating

New vinyl coating easy to use

Development of Ucilon* 1400 now simplifies the application of a durable vinyl protective coating to walls, ceilings and the exterior of equipment.

Self-priming, this new coating goes over old paint without lifting it. It has a mild odor, and displays easy brushability.

While applying as easily as ordinary oil paint, it gives extraordinary corrosion protection. Ucilon 1400 resists acids, alkalies, water and numerous other causes of coating failure. Send for data sheet.

*Trade Mark

How engineers put corrosion resistance into steel drums

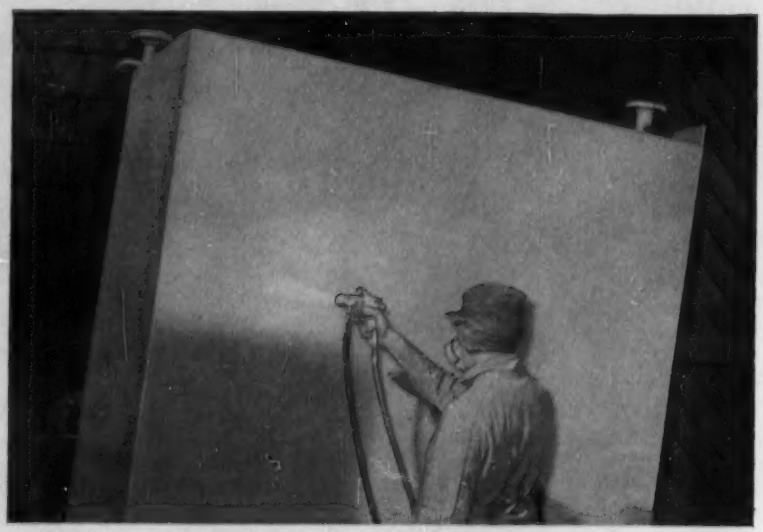
Engineers have at their command many types of chemical-resistant coatings to line drums. But which proves best for a new product? That's where a coating manufacturer comes in to help.

Unichrome drum linings include vinyl, phenolic, epoxy and plastisol formulations. These meet most needs on chemical resistance. Beyond this, they satisfy also on the impact resistance, adhesion, film continuity, distensibility and flexibility needed for the service. Engineers need only specify the requirements to have Metal & Thermit recommend the best lining to prevent corrosion and product contamination.

METAL & THERMIT
CORPORATION

General Offices: Rahway, New Jersey
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
Metal & Thermit—United Chromium of Canada, Limited, Toronto

Unichrome "Super 5300" Coating builds 60 mil film per coat . . . gives heavy duty corrosion-protection



Tank getting a heavy protective coating with Unichrome Plastisol. Large structural parts of products can likewise be durably finished.

A new and unusual plastisol formulation has been developed by Metal & Thermit, a pioneer in this type of coating. Unichrome "Super 5300" Coating delivers the full solids content of vinyl plastisol right through a spray gun. It enables a coat 60 mils or more to be applied successfully in one application.

THICK AND TOUGH

Amounting to a vinyl "sheet" material, single or multiple coats of this new plastisol can be used to good advantage on many of the products where plastic or rubber sheets are generally specified. Super 5300 Coating also provides a durable, protective finish for large uneven surfaces where only a fluid material can be applied. Good performance is assured for two reasons. (1) With spraying, there are no seams or joints where corrosives might penetrate. (2) Vinyl plastisols have a unique combination of chemical and physical properties.

THE ADVANTAGES

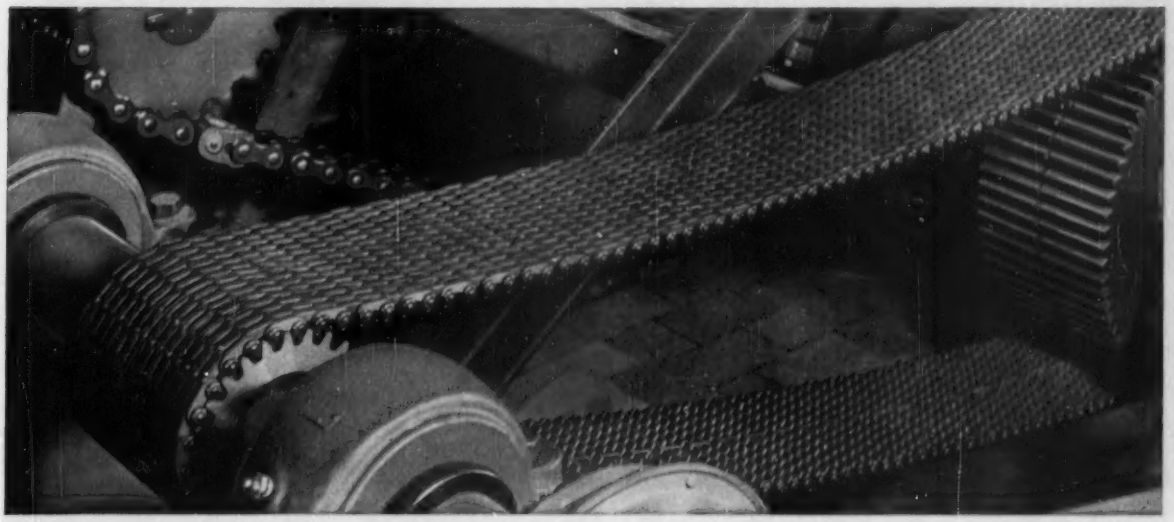
Curing quickly at 350° to 365°, Unichrome Plastisols form rugged, resilient coatings with an attractive satin finish. They insulate electrically, absorb impact, don't chip or crack, resist abrasion and erosion, deaden sound.

They give extraordinary protection against a wide range of acids, alkalies, alcohols, salt solutions and moisture. With plastisol protection, ordinary metal parts and products often prove suitable for unusually severe service conditions.

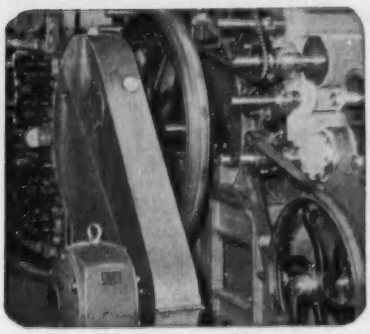
For companies without adequate baking facilities, Metal & Thermit can recommend nearby firms that specialize in applying "Super 5300" Coating. Send for Bulletins that tell more about plastisols.

Check your drives against the benefits of

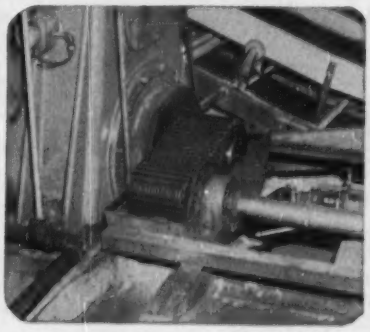
LINK-BELT silent chain



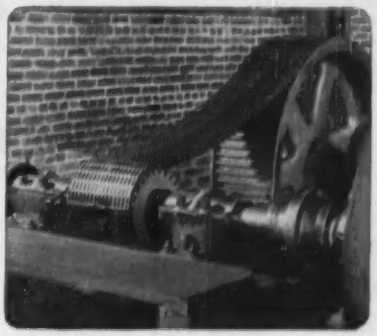
☐ **HIGH SPEED.** Link-Belt silent chain drives are noted for slipless dependability—maintain better than 98% efficiency whether operating over large or small diameter wheels or on long or short centers. For further details on these and more advantages, call your Link-Belt office or authorized distributor.



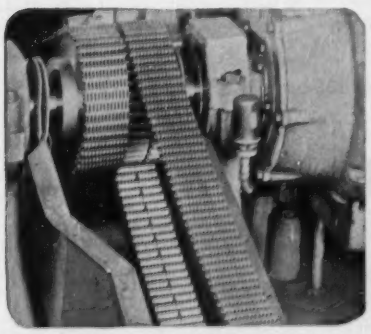
☐ **ADVERSE OPERATING CONDITIONS.** Heat, humidity, cold do not lower Link-Belt silent chain's great efficiency.



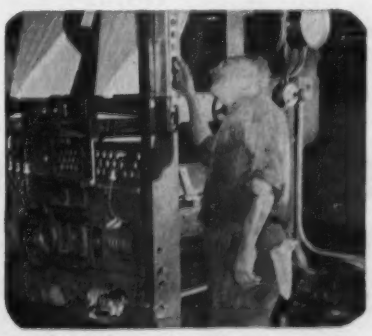
☐ **LARGE OR SMALL HP.** A versatile line, these Link-Belt drives are available from fractional to thousands of hp.



☐ **LARGE RATIOS.** Link-Belt silent chain operates efficiently on extremely short centers at ratios as high as 10-to-1.



☐ **LIMITED SPACE.** Easy to assemble in close quarters, Link-Belt silent chain permits built-in drives, compact housings.



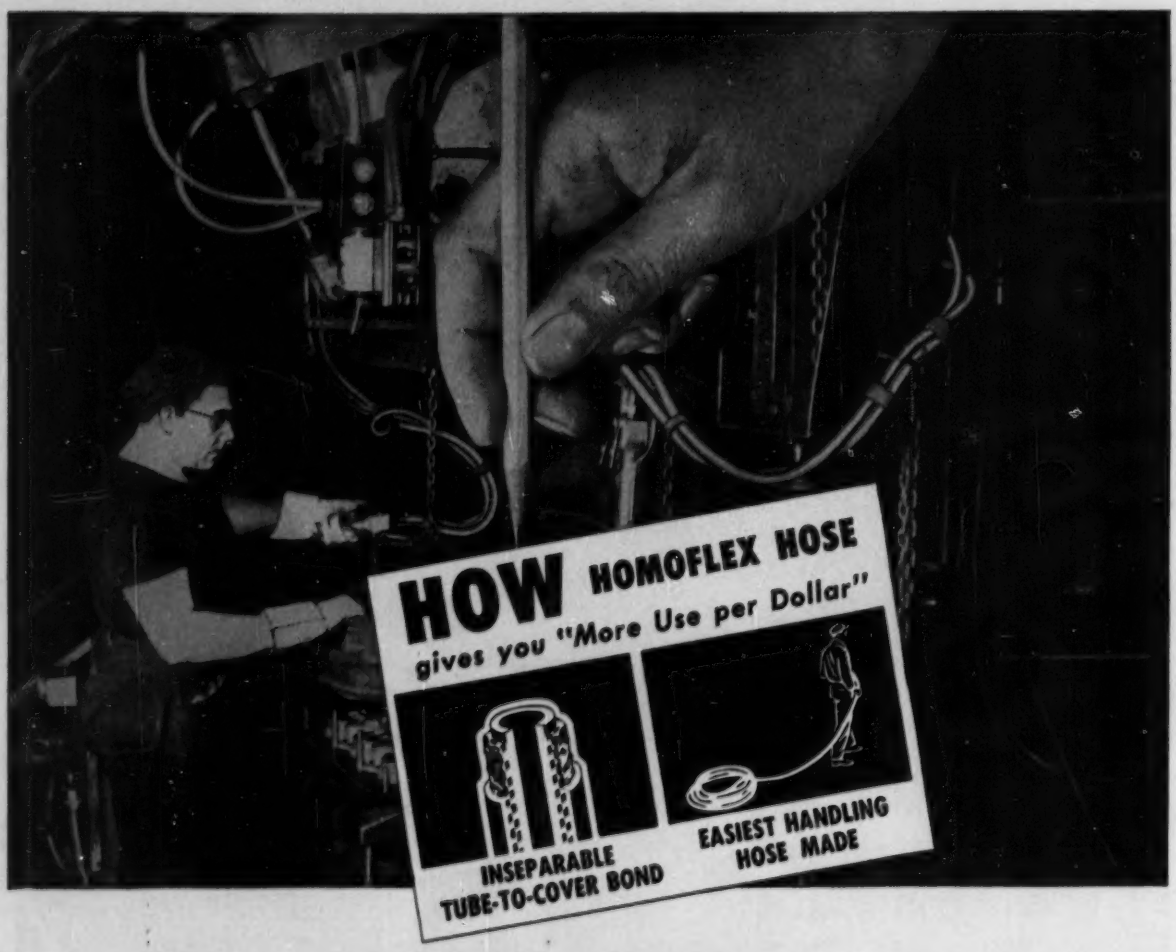
☐ **LONG LIFE.** After 13 years on this newspaper press at speeds up to 4,700 fpm, Link-Belt silent chain is still efficient.

Ask for 88-page Book 2425 — complete data on Link-Belt silent chain drives.

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.



This Rugged Hose Handles Like a Rope!

Strong enough to stand up under the toughest job conditions, Homoflex Hose is light in weight and as flexible as a rope. It's the easiest handling hose made for use with air, water, and other fluids and gases! The exclusive Homoflex construction increases hose life, too . . . assuring you "More Use per Dollar" for every length you buy.

Homoflex Hose has no pre-set twist. It is mandrel-made to coil and uncoil freely in any direction without kinking. This eliminates the strain that could otherwise lead to costly internal damage and hose rupture. An exclusive process creates a homogeneous, inseparable tube, strength member and cover bond that combines maximum flexibility with rugged strength and durability. Homoflex Hose reduces hose costs because its easier handling features enable workers to get more work done . . . and because it lasts longer. Couplings are easier to fit, too, because Homoflex Hose maintains uniform inside diameters.

Ask your R/M representative about easy handling Homoflex Hose for your operations. He'll also tell you how other types of R/M Hose for general and special purposes do a better job, longer . . . give you "More Use per Dollar".

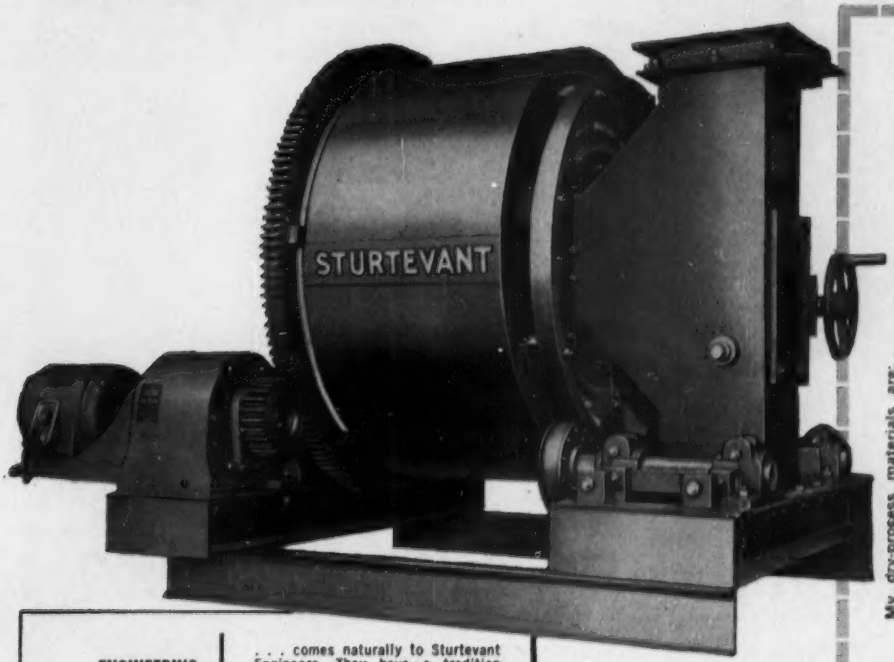
RM 647

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

COSTS OF BETTER BLENDS CUT TWO TESTED WAYS



ENGINEERING BLENDING AND OTHER DRY PROCESSES TO SPECIFICATIONS

. . . comes naturally to Sturtevant Engineers. They have a tradition of solving dry-processing problems since 1873. Sturtevant custom-built equipment and plants are well-known for their low-maintenance-cost operation. If your problems include any of the processes listed on the coupon, it will pay you to investigate.

Sturtevant Dry-Batch Blenders:

1. **SPEED UP PRODUCTION WITH 4-WAY MIXING**
2. **SHORTEN SHUT-DOWNS WITH "OPEN-DOOR" DESIGN**

Batches from 500 to 40,000 pounds come out of Sturtevant Dry-Batch Blenders exactly as you want them. They are completely blended regardless of the varying weights, densities or fineness of the different ingredients. And no dust is lost in the process. **Four different vertical and lateral mixing actions** inside the sealed rotating drum achieve thorough blending in minimum time. Single lever control of a single gate speeds up loading and discharging.

"Open-Door" accessibility makes cleaning and maintenance a matter of minutes. This original Sturtevant advantage plus 75-year-tested rugged construction assures more output per machine-year. Check the coupon for more information.

STURTEVANT

Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

My dry-process materials are:_____

Desired capacity is:_____

Name_____ Title_____

Firm_____

Street_____

City_____ Zone____ State_____

STURTEVANT MILL COMPANY, 100 Clayton Street, Boston 22, Mass.

Please send me your bulletin on Dry Blenders ☐
Also bulletins on machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ MICRON-GRINDING ☐ SEPARATING ☐ BLENDING
☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

When it comes to water conditioning . . .

HOW MUCH "TOLERANCE" CAN YOU AFFORD?

Very little, probably, if your plant is typical. You *know*, of course that exacting water treatment is required to make your local water supply precisely right for your use. But you know, too, that there are as many variations in water needs as there are industries.

As Elgin installations in hundreds of plants and institutions can testify, it is our business to design, build and install water conditioning equipment that will best meet your requirements — within exacting tolerances.

As specialists in water conditioning for nearly half a century, we have been face to face with nearly every water treatment problem imaginable. If, for example, your operations call for simple ion-exchange softening, Elgin can offer water softening equipment — in a wide range of capacities — together with an Elgin ion-exchange zeolite especially tailored to do the job with efficiency and economy. For boiler feed or process water, Elgin can provide filtration, neutralization, de-alkalization, de-aeration, de-mineralization or de-gasification. Even if you need water of *highest known chemical purity*, Elgin can offer you the Ultra-DeIonizer . . . for water of greater chemical purity than that produced by triple distillation—*at a tiny fraction of the cost.*

Talk over your water conditioning problems with your Elgin representative. The entire Elgin engineering staff is at your service to help solve the problem quickly and inexpensively. Or, if you'd rather, please feel free to write directly to us for any information you may need.

ELGIN WATER CONDITIONING

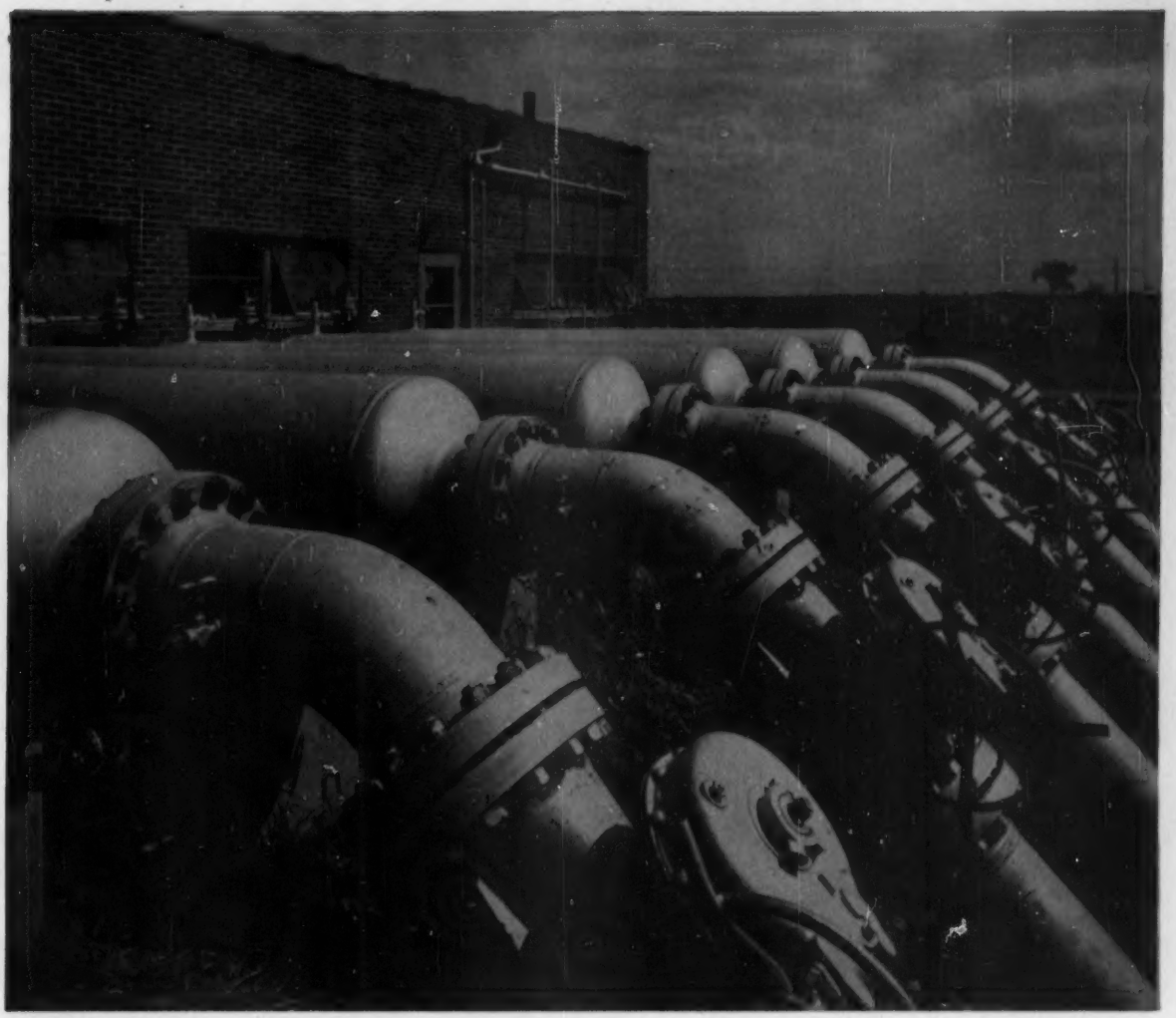
ELGIN SOFTENER CORPORATION

160 No. Grove Avenue, Elgin, Illinois

Representatives in Principal Cities

In Canada: G. F. Sterne & Son, Brantford

SOFTENERS ION EXCHANGERS FILTERS DEIONIZERS DEALKALIZERS LIME COAGULATORS DEGASITORS DEAERATING HEATERS



Natural gas—400 million cubic feet a day—pours into the Petro Extraction Plant from the Panhandle Eastern Tuscola compressor station. After removal of hydrocarbons, the gas is returned to Panhandle Eastern lines for transmission as fuel gas.

Petrochemicals . . .

from pipeline gases

At the Petro plant—Tuscola, Illinois—an endless stream of natural gas is being separated into ethane, propane, butane and natural gasoline.

products you need

The ethane is converted into ethylene, which is in turn converted to ethyl chloride, ethyl alcohol, ether and polyethylene. U.S.I. ammonia and sulfuric acid plants next door supply and receive raw materials.

for the future

Petro can manufacture products other than these if the demand arises—products that can be made from the many raw materials available at the plant site.

in bulk quantity

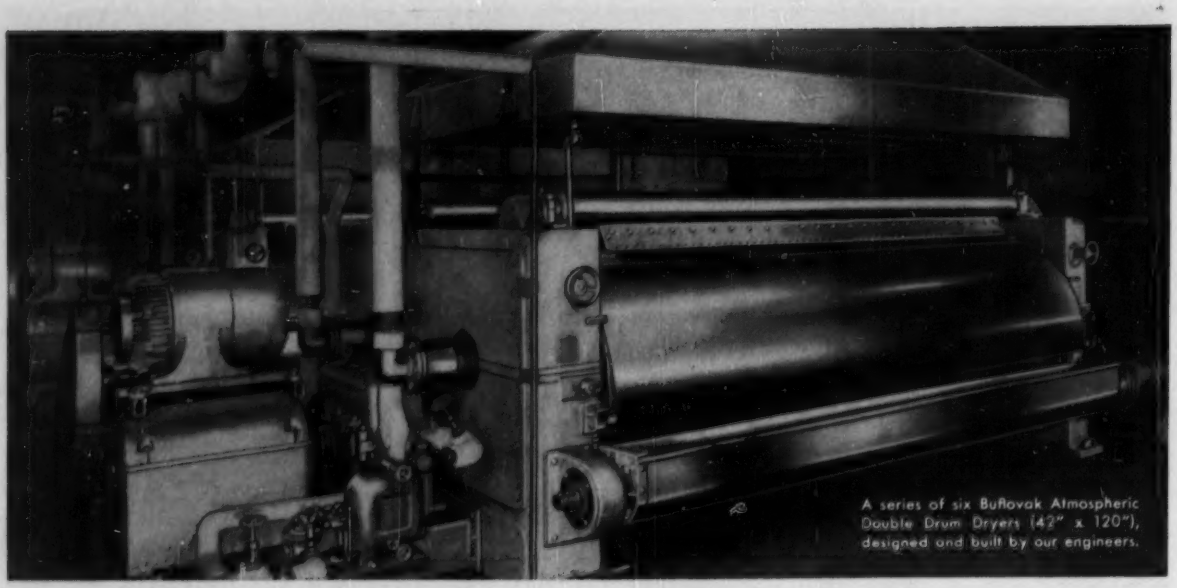
Why not add this plant to your facilities? Our engineers will be glad to discuss your long-term bulk requirements for chemicals from National Petrochemicals Corporation.

NATIONAL PETRO-CHEMICALS

CORPORATION

A joint enterprise of National Distillers Products Corporation and Panhandle Eastern Pipeline Company

99 PARK AVENUE, NEW YORK 16, N. Y.



A series of six Buflovak Atmospheric Double Drum Dryers (42" x 120"), designed and built by our engineers.

BLAW-KNOX Process Engineers are ready to serve you ... no matter how simple or how complex your process problem is, nor what size unit of equipment you need—from a laboratory or pilot plant model to a complete processing system

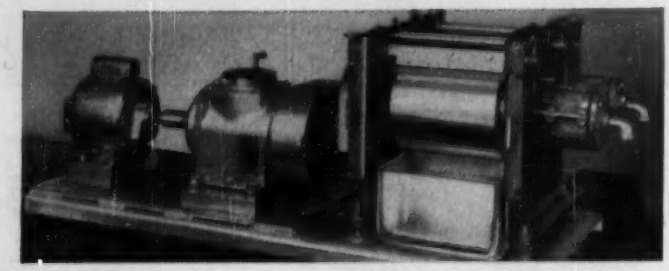
Blaw-Knox Process Engineers have been engineering, designing and building process equipment for decades.

Included in this service have been small kettles for making a few gallons of paint to several thousand resins

- . . . large autoclaves for high temperature, high pressure reactions
- . . . dryers of every type, atmospheric and vacuum, single drum and double drum, rotary and shelf spray and others
- . . . evaporators of many kinds and sizes, downflow, and forced flow, open and enclosed types, crystallization, and by-product recovery
- . . . pilot plant and laboratory equipment.

This experience and the vast fund of technical knowledge is available to help you, whether it is a test run in our Research and Testing Laboratory, a small piece of equipment to fit your needs, engineering and building a specific unit to your designs, a complete process project, or an estimate and a recommendation.

Do not hesitate to call on us. Your inquiry will receive prompt attention.



A COMPLETE PROCESS EQUIPMENT SERVICE

Kettles of every description constitute but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries: EVAPORATION • VULCANIZING FLAKING • CRYSTALLIZATION • POLYMERIZATION MIXING • SOLVENT EXTRACTION • GAS CLEANING DRYING • SOLVENT RECOVERY • HEAT TRANSFER IMPREGNATING • DISTILLATION • CONDENSATION REACTION • LOW AND HIGH PRESSURE PROCESSING GAS ABSORPTION • VAPORIZATION • STERILIZING

BLAW-KNOX COMPANY

BUFLOVAK EQUIPMENT DIVISION

1551 Fillmore Avenue, Buffalo 11, N.Y.

Makers of process equipment engineered for any pressure, temperature, capacity, reaction

50th Anniversary BLAW-KNOX 1906-1956

R.S.B.
Edward checks are competitively priced, yet we get many "extras."
M. A. L.

Here is a really dependable Pressure-Seal gasket — sets over a much wider area. Edward inlays body for excellent gasket surface.

Equalizer aids disc-piston life, reduces motion and extends life of guiding surfaces. These piston checks seat tightly and have non-clogging characteristics.

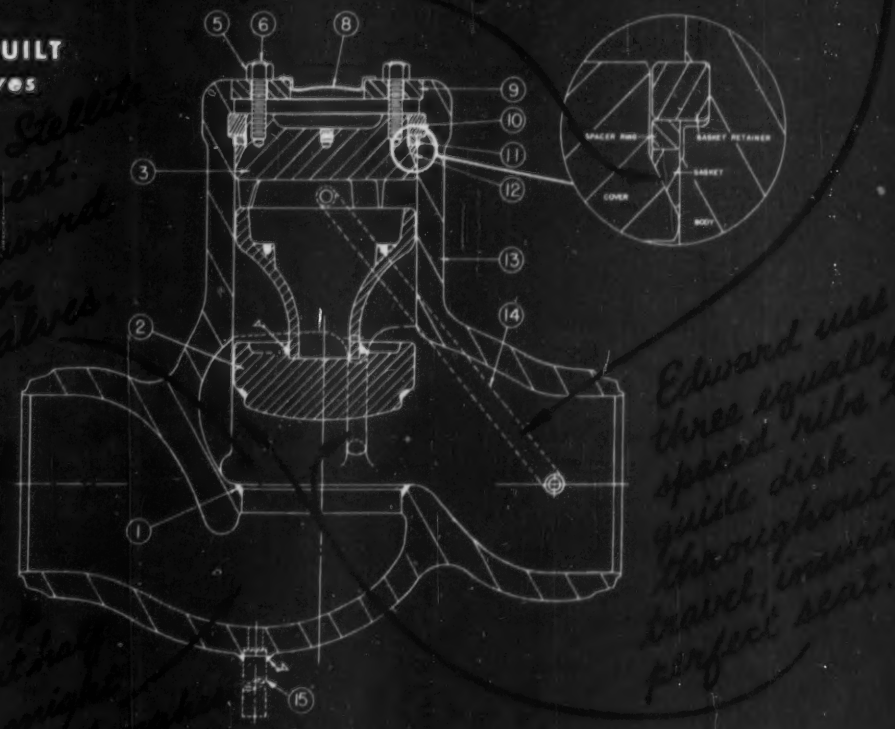
Integral Stellite seat is set. Only Edward has it on large valves.

Screwed-on body prevents leaks. Pressure drop is only about half what you might guess. Edward makes straight-through check valves too.

Edward uses three equally spaced ribs to guide disk throughout travel, insuring perfect seat.

Let's have Edward quote on the checks as well as all steel valves on our next job.

ROCKWELL BUILT
Edward Valves



LIST OF MATERIAL
QUANTITIES ARE FOR ONE VALVE
WHERE A.S.T.M. SPECIFICATIONS ARE INDICATED THE LATEST REVISION APPLIES

PIECE NO.	NAME OF PIECE	NO. REQ'D	MATERIAL	SPECIFICATIONS	EDWARD MS NO.
1	SEAT	1	INTEGRAL WITH BODY	STELLITED	481
2	DISK	1	FORGED ALLOY STEEL WITH STELLITED SEATING FACE	A.S.T.M. A182 GRADE F11 WITH 0.012" MAX. CHROME MOLYBDENUM WELD	227 481
	PISTON WELDED TO DISK	1	CAST STEEL	A.S.T.M. A216 GRADE WCB	102
3	PRESSURE SEAL COVER	1	CAST STEEL C - 0.25% MAX	A.S.T.M. A217 GRADE WC1	209
5	COVER STUD NUTS		STEEL	A.S.T.M. A194 GRADE 2H	127
6	COVER RETAINER STUDS		ALLOY STEEL	A.S.T.M. A193 GRADE B7	208
8	COVER RETAINER COVER	1	STEEL		
9	COVER RETAINER	1	STEEL PLATE	A.S.T.M. A212 GRADE B	115
10	GASKET RETAINER	1	EVANLOY	A.S.T.M. A182 GRADE F6	212
11	SPACER RING	1	STEEL		
12	PRESSURE SEAL GASKET	1	ARMCO IRON - 90 BHN MAX.	MALLEABLE PLATED	506
13	BODY	1	CAST STEEL C - 0.30% MAX.	A.S.T.M. A216 GRADE WCB	102
			CAST STEEL C - 0.20% MAX.	A.S.T.M. A217 GRADE WC6	226
			CAST STEEL C - 0.18% MAX.	A.S.T.M. A217 GRADE WC9	242
14	EQUALIZER #	1	CHROME MOLYBDENUM	SCHEDULE 160 PIPE	229
15	DRAIN NIPPLE	1	CHROME MOLYBDENUM	SCHEDULE 160 PIPE	229

EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

EDWARD PRESSURE SEAL
CAST STEEL HORIZONTAL CHECK VALVE
GENERAL ASSEMBLY

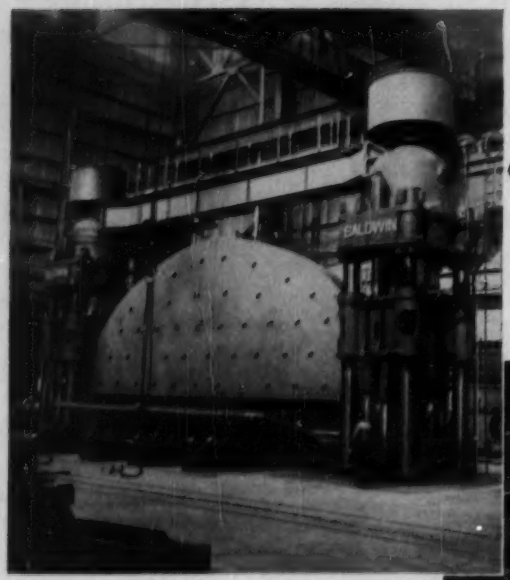
DRAWN:	APP'D:	DRAWING NO.
CHK'D		AE-3316-6
APP'D	DATE 2-7-35	

Edward builds Globe and Angle Stop, Non-Return, Check, Stop-Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

Foster Wheeler's exceptional facilities for

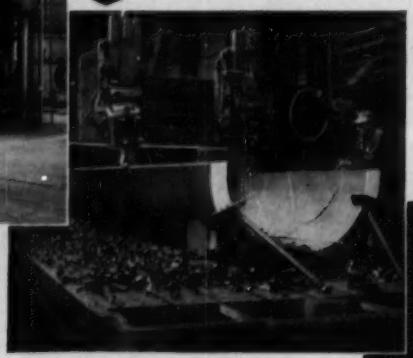
HEAVY FABRICATION

can solve your toughest forming, machining and welding problems



This huge, 8000-ton hydraulic beam press easily performs bending and forming operations on steel plates up to 9 inches thick and 39 feet in length.

Here, on one of the largest double housing planers in the country, welding grooves are machined in one half of a cylinder for a large pressure vessel.



Twin arc automatic submerged arc welder joins two longitudinal half shells for a 6-inch thick pressure vessel.

With four large and exceptionally well equipped plants — at Carteret, N.J., Mountaintop, Pa., Dansville, N.Y. and St. Catharines, Ontario — Foster Wheeler offers a unique fabricating service to industry. High-pressure vessels, heavy-wall pipe and unusual weldments to Code requirements and beyond, as well as your lighter fabrications, can be produced by the most modern and efficient methods, with substantial savings in time and cost.

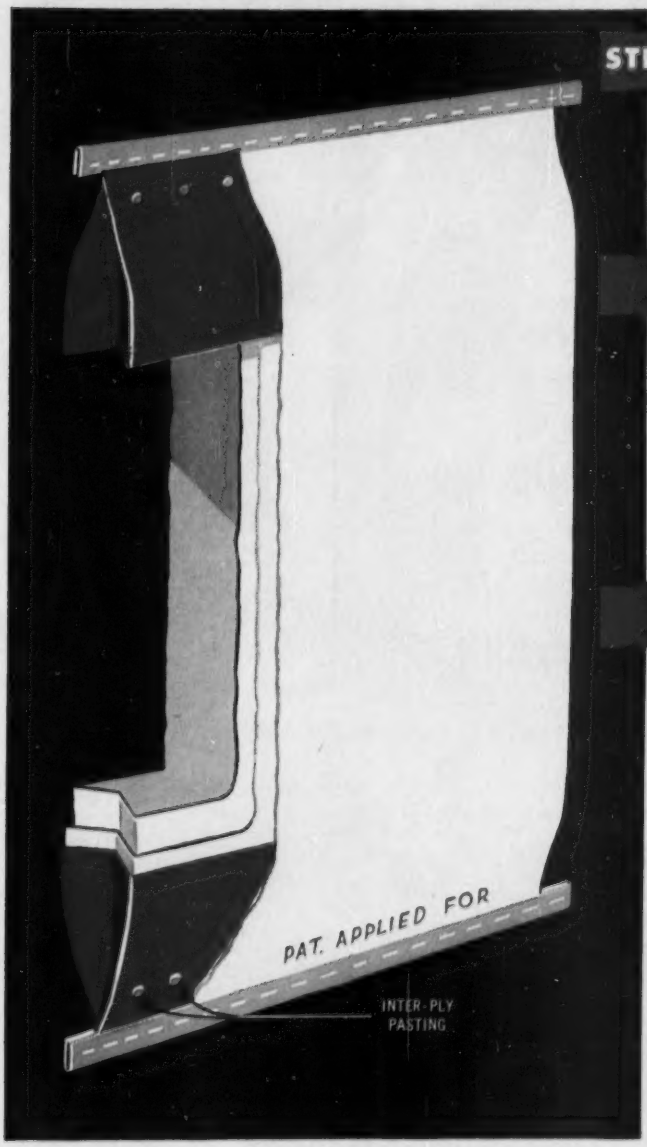
For More Complete Information on Foster Wheeler fabricating facilities, send for your copy of our new, 20-page Bulletin No. GS-56-4. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

New *Strength-end* * Bemis Multiwalls

the shipping sack with BALANCED STRENGTH



STRONGER AT THE RIGHT PLACES

New Bemis Strength-End Multiwalls, strengthened top and bottom where most sewn bag breakage is experienced, will cut packing troubles and costs for you.

TWO WAYS TO SAVE

You'll save money one of these two ways with Bemis Strength-End Multiwalls: You may switch from a more expensive type of shipping container. Or, if you are already using multiwalls, you might use bags with fewer plies, because of the greater end strength, where it is needed. Bemis Strength-End Multiwalls may, at lower cost, do your job as well or better.

SUCCESSFULLY TESTED

Bemis Strength-End Multiwalls have been successfully tested in all sections of the country and under all climatic conditions. They have proved themselves for packing cement, fertilizer, chemicals, flour, salt.

Here's how it's reinforced

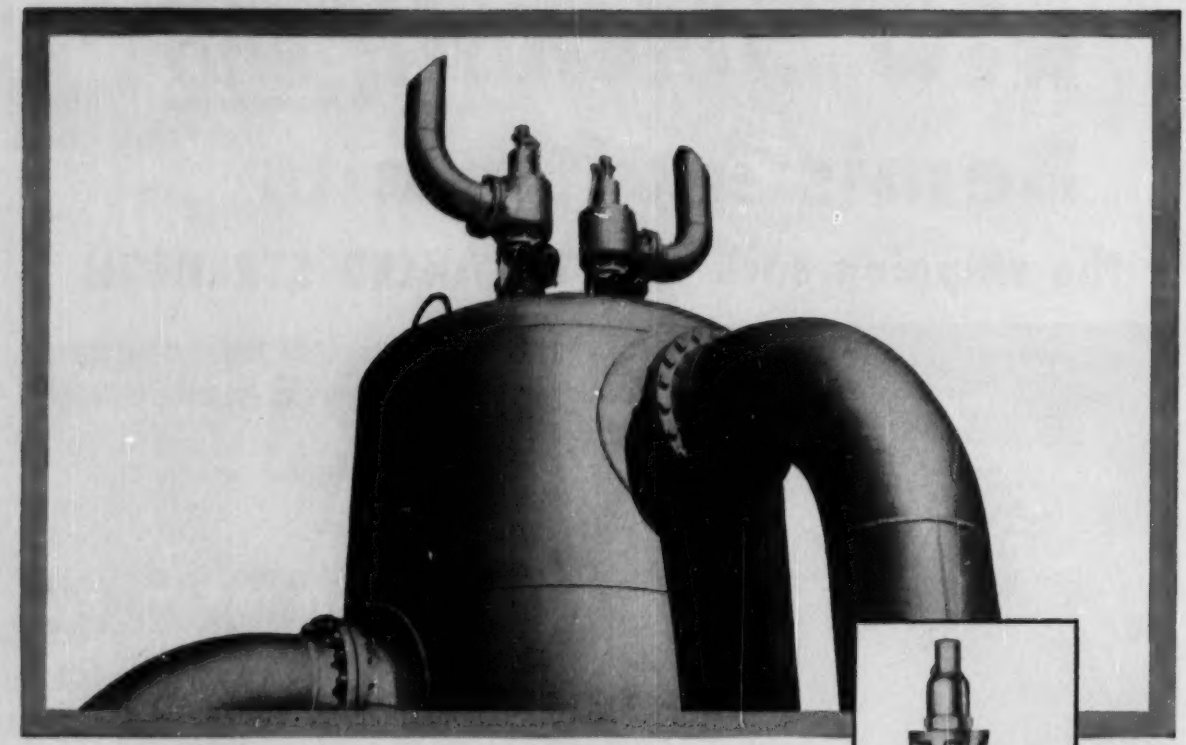
The reinforcement in Bemis Strength-End Multiwalls is a strip of sturdy kraft, several inches wide, running horizontally around the bag at the ends . . . anchored to the other walls so it works in conjunction with them . . . and adding greatly to the strength both at the sewing line and at the gusset corners. It's just plain, common-sense, balanced strength construction.

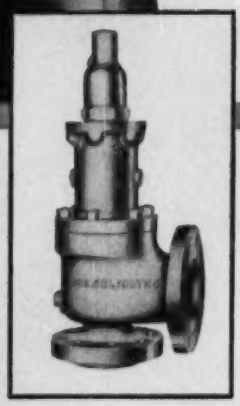
*TRADE-MARK

Get the complete story about Bemis Strength-End Multiwalls from your Bemis Man.

Bemis BEMIS BRO. BAG CO.

General Offices—St. Louis 2, Mo.
Sales Offices in Principal Cities





★ **Economical "2 in 1" Design**
★ **Peak Performance**
★ **Absolute Protection**
★ **Maximum Interchangeability**

CONSOLIDATED SAFETY RELIEF VALVES GIVE YOU ALL FOUR—AND MORE

Consolidated Safety Relief Valves satisfy *every* requirement of the most advanced processing facilities. Valve action is *consistently* positive. You get peak performance even where discharge lines are long or there is low "superimposed" back pressure in the relieving system!

The Standard type can be converted to Bellows type *in the field*. Center-to-face dimensions of inlet and outlet are such that you can interchange these valves with the safety relief valves of other manufacturers. Real flexibility of application that cuts inventory costs! Optically-ground flat seating surface and fewer functional parts than comparable valves contribute greatly to easier, more economical maintenance.

Get top economy and absolute protection with Consolidated Safety Relief Valves. Full range of sizes and pressures available. Write for Catalog 1900 for complete information.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

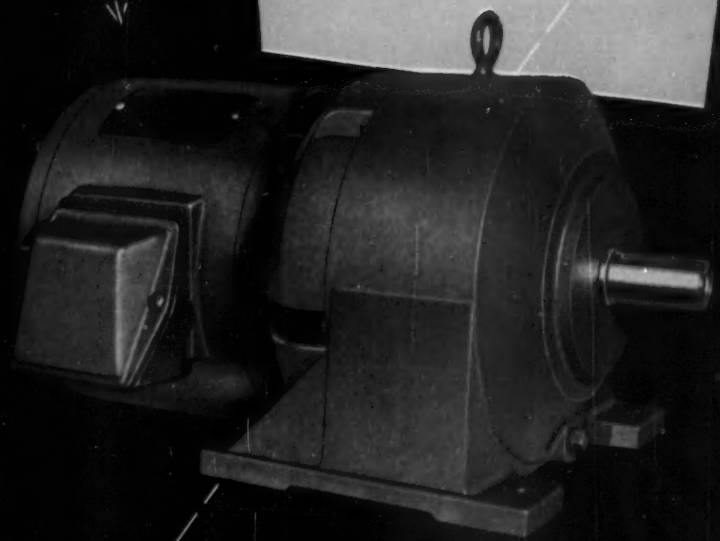
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

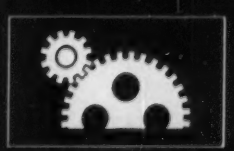
Don't overlook what you can't see



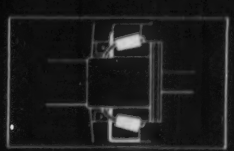
You can't always see what makes a gearmotor outstanding. It's the attention paid to small design details that makes the difference. Here are a few of the details that make the new Reliance Gearmotor stand above the rest.

FOOLPROOF METERMATIC motor bearing lubrication and oil bath gear lubrication for long-life protection against wear.

INDUCTION HARDENING of the tough alloy steel gears gives a perfect combination of wear resistance and strength.



SIMPLIFIED GEARING with few moving parts reduces friction losses and lessens chances of breakdown.



THRUST BEARINGS handle heavy overhung loads safely by placing strain on the frame instead of the shafts.

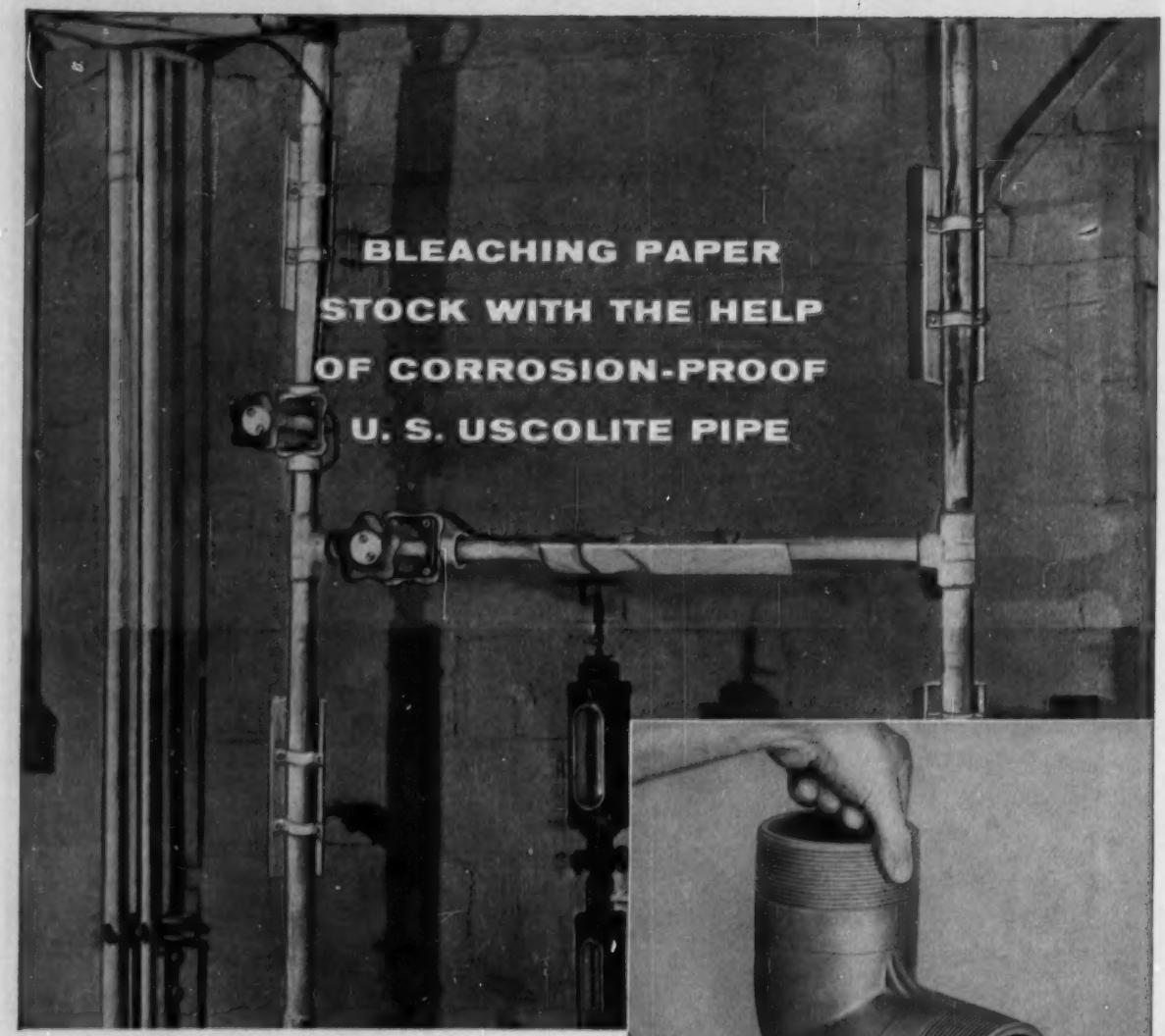
Find out the complete story for yourself—contact your Reliance representative or write for Bulletin E-2408.

REDUCE SPEED

RELIANCE ELECTRIC AND ENGINEERING CO.

CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES

Canadian Division: Welland, Ontario



Milk of lime rotameter, used in the control of the pH of the stock in a double-shaft mixer. The piping is U. S. Uscolite with Uscolite (Hills-McCanna) valves.

Uscolite pipe and fittings are made in the broadest and largest line of stock sizes on the market. Sizes run from ½" to 6".

The paper mill, located in Pennsylvania, selected U. S. Uscolite® plastic pipe because it's immune to the corrosive chemicals used in the bleaching process, and requires *no upkeep*. The piping previously used just couldn't stand the gaff.

Made by United States Rubber Company, Uscolite is an extremely tough but lightweight thermoplastic pipe. It imparts no odor, taste or discoloration. It is threaded and assembled with ordinary piping tools—*without* special preparation. Uscolite is in use in thousands of installations in every industry where constant control of chemicals, acids or corrosion is a problem.

For replacement or completely new piping, get in touch with any of our selected distributors or any of the 27 "U.S." District Sales Offices or write us at Rockefeller Center, New York 20, N. Y. Immediate delivery of standard sizes and threaded fittings. The Hills-McCanna Uscolite valve is available for your piping assembly.

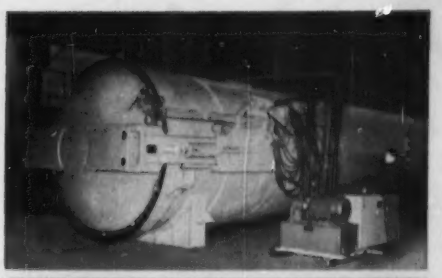
Mechanical Goods Division

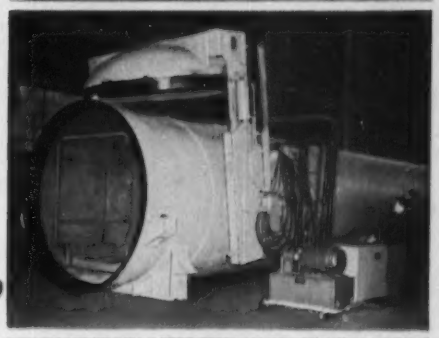
United States Rubber

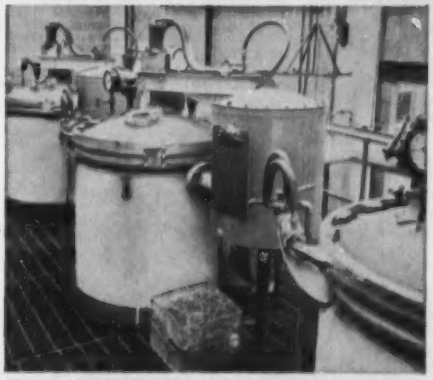
Struthers Wells

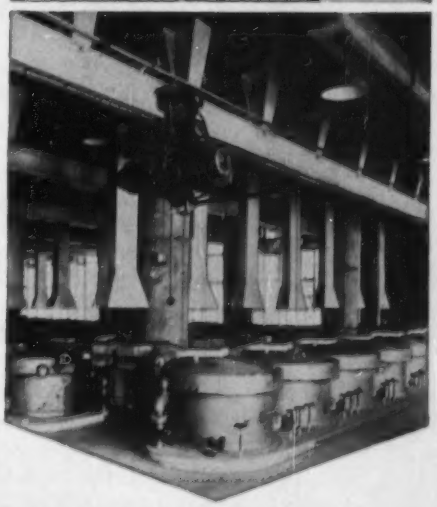
QUICK OPENING DOORS

BOLTLESS PATENTED







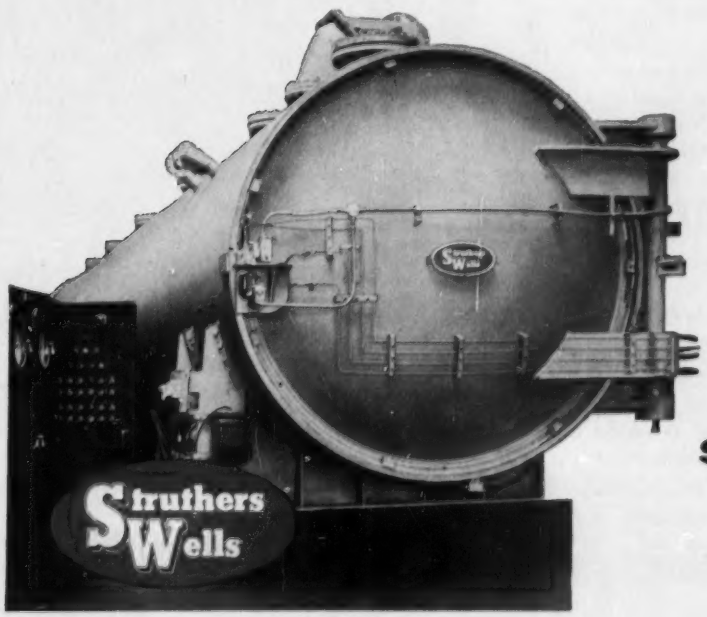


For Horizontal or Vertical Pressure Vessels

Designed and Built to Your Specifications

Struthers Wells' patented engineering achievements provide important advancements in Quick Opening Doors—for all sizes of vulcanizers, devulcanizers, impregnators, sterilizers, ovens, cylinders, etc. These fast, smooth-operating doors feature simplicity of design, ease of handling, savings in floor space, and a lifetime of dependability. Illustrated are a few applications of Quick Opening Doors on large and small vessels. Consult Struthers Wells for doors best suited to your specific requirements.

Write for Bulletin SW-553



STRUTHERS WELLS
CORPORATION
TITUSVILLE, PA.

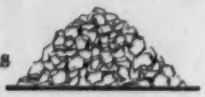
Plants at Titusville and Warren, Pa.
Offices in principal cities

Product purification has many magnetic answers

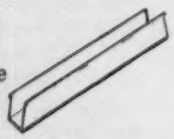
You want a clean pure product free from dangerous

tramp iron You need a magnetic separator to remove this iron contamination.

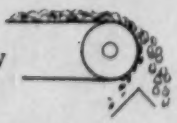
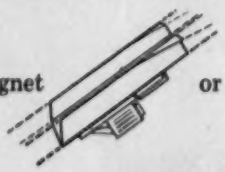
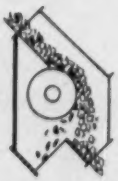
But what kind of magnet? First you contact a Stearns Magnetic engineer

He checks your product; granular or powder chunks 

liquid ; the kind of tramp iron, such as mixed scrap or tiny iron

particles ; the kind of conveyor like belt chute 

or pipe Based on these and many other factors, he might recommend a

magnetic pulley  or a spout magnet  or a magnetic drum 

or suspended magnet or multiple stage cross belt ;

or if the product is liquid, a magnetic filter or a pipe trap magnet

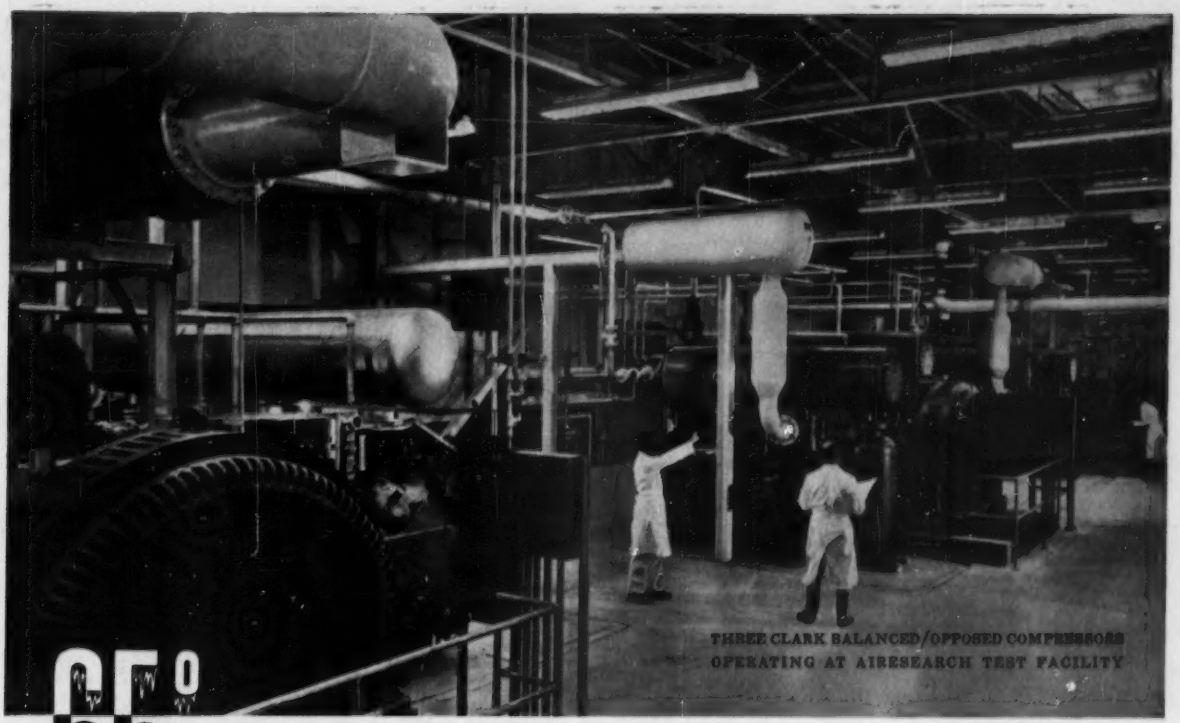
Stearns Magnetic, Inc. builds all these plus other highly specialized magnetic separators, electro or permanent, either in standard models or custom-built to your exact needs. We will be happy to send you literature on any of the separators mentioned above — or answer specific questions on tramp iron removal or product purification. Complete laboratory facilities available for testing materials. Write, wire or call us or see your Stearns Representative.

1127

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

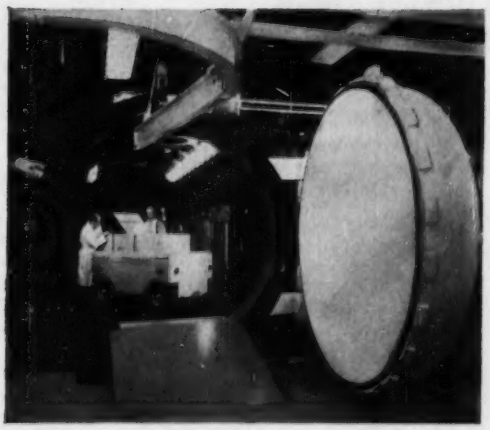
STEARNS MAGNETIC, INC., 629 S. 28th St., Milwaukee 46, Wis.



THREE CLARK BALANCED/OPPOSED COMPRESSORS OPERATING AT AIRESEARCH TEST FACILITY

65° below zero in the middle of the desert

Clark Air Compressors furnish the power



GIANT ALTITUDE CHAMBER FOR HOT AND COLD TESTS

Mass production testing of aircraft components such as air turbine starters, refrigeration turbines and other units was what the AiResearch Division of the Garrett Corporation wanted. To meet this need, they built giant test facilities next to their factory in the middle of the Arizona desert at Phoenix featuring seventy-five test cells.

To provide most of the air to operate test equipment AiResearch installed three Clark Model CRA-4 Balanced/Opposed Motor-Driven-Compressors having a combined rating of 4750 horsepower. Up to 42 tons of air per hour can be delivered. Temperatures range from a frigid −65° to a blistering 1000°F while pressures of from vacuum to 1000 psi can be provided.

For your air needs in the 150-4500 horsepower range, Clark has an ultra modern Balanced/Opposed Compressor to fit every application. Your nearest Clark representative will give you complete information or write for Bulletin 118.

CLARK BROS. CO., OLEAN, N. Y.
One of the Dresser Industries
Offices in Principal Cities Throughout the World

CLARK®

Balanced/Opposed Air Compressors

ACCELERATION

COLLISION IMPACT IMPLOSION

in a Gaulin Homogenizer makes many products better – more economically

A Gaulin Homogenizer does three very important things to a product — it shears, expands and explodes, agglomerates down to their ultimate particle size.

The results of this particle acceleration go far beyond just making products uniformly finer, faster, more economically. In most cases, the physical characteristics of a product are modified.

For example, here are some typical property changes. A Gaulin will *stop* separation. *Accent* taste, scent, and color. *Improve* texture, flow lubricity. *Speed* chemical reactions, and dispersion of ingredients. And *reduce* the amount of expensive materials needed.

How about your product?

We'll be glad to show you just how a Gaulin can improve your product — and work with you toward solving any specific problems you may have. Write today for more information.

MANTON-GAULIN MFG. CO., INC., 71 Garden Street, Everett 49, Mass.

Some Typical Products Improved by Gaulin Homogenizers

PHARMACEUTICAL
Emulsions and dispersions. Gaulins make them stable, uniformly finer. Permit accurate reproduceability.

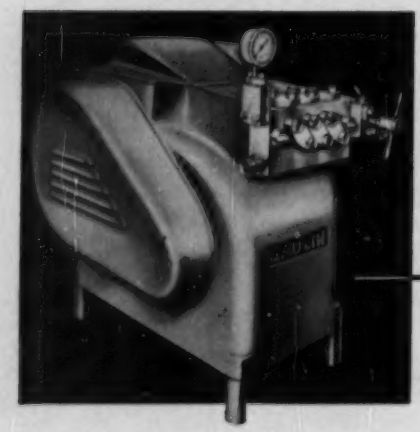
LIQUID STARCH
Improves transparency, clarity, and stops separation, at lower cost than other methods.

GREASE
Improves lubricating value and stability. Increases service life.

PIGMENT DISPERSIONS
Provides continuous high capacity producing dispersions of ultimate particle size.

COSMETIC EMULSION
Gives smoother texture, longer shelf-life. Locks in perfume against evaporation.

WAXES
Makes accurate reproduceability possible. Provides uniform, stable emulsions and convenient viscosity control. Increases gloss.



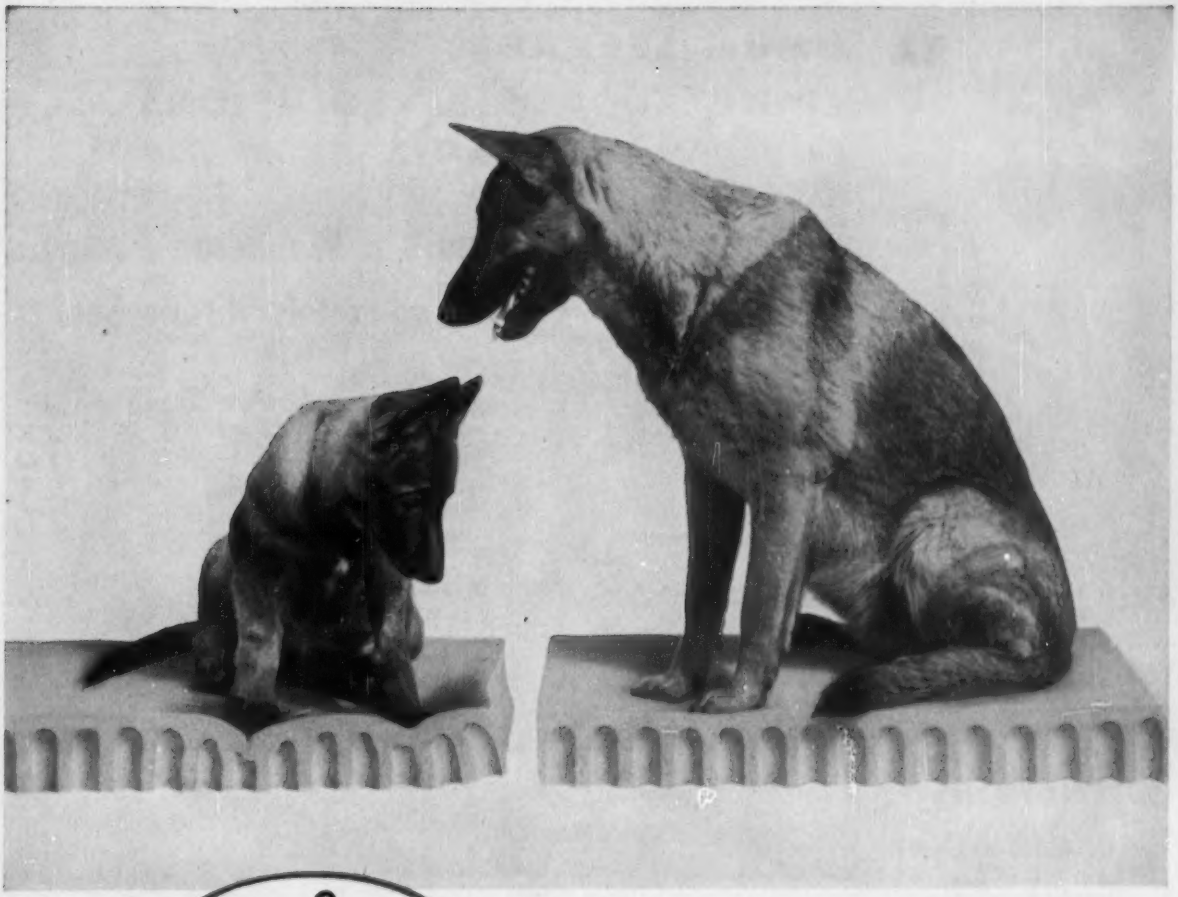
GAULIN PILOT PLANT HOMOGENIZER
Ideal for experimental purposes, operation or process requiring up to 25 gallons per hour capacity. Handles quantities as small as one pint. Available on low rental basis.

GAULIN TWO-STAGE COLLOID MILL
Stator is jacketed for cooling or heating. Gap setting adjustable for .001" to .045". Only 45 seconds clean-up required in changing colors. 12" head room. 12" x 17" floor area.

Gaulin

HOMOGENIZERS

WORLD'S LARGEST MANUFACTURER OF HOMOGENIZERS, TRIPLEX STAINLESS-STEEL HIGH PRESSURE PUMPS, AND COLLOID MILLS



Now! VINYL foam ...so versatile, it can be varied to meet your needs!

because it's made of **Firestone**

A totally new foam product with exceptional durability, economy and, most of all, *versatility*—became possible through the development of the vinyl plastisol resin. (Exon 654 in the Firestone line of vinyls.)

Vinylfoam is produced by the Elastomer process, using Exon 654 as the base resin.

Molded in cored or slab form, it can be modified at no extra cost to be as soft or as firm as you need, as light or as heavy, as thick or as thin, as resilient or as "dead."

It can be electronically heat-sealed without affecting any of its properties.

Exon 654 makes Vinylfoam exceptionally resistant to abrasion, corrosion, flame, aging, moisture, tearing and chemical action. With maximum dimensional stability, it resists oxidation, hardening and drying out.

It can be embossed, die cut, split or skived; molded directly onto textiles and most synthetics, and onto vinyl sheeting or film in continuous lengths. Mutual surface impregnation forms a homogeneous bond.

Vinylfoam gives products in almost every field new comfort, safety, durability. Vinyl's economy makes them cost less, sell easily.

EXON

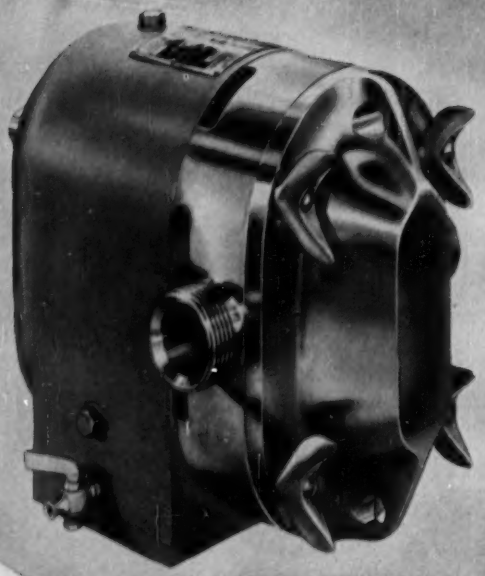
VERSATILE VINYL RESINS
engineered answers to industry's needs

Firestone Plastics Company supplies the plastisol resin for Vinylfoam... does not make the finished foam itself.

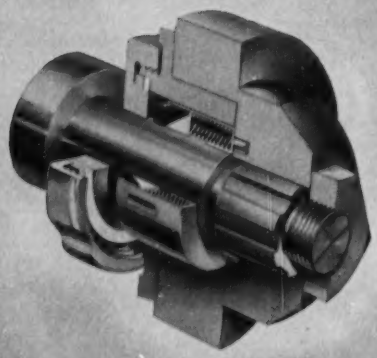
For complete information or technical service on the entire line of Exon resins, call or write today:
CHEMICAL SALES DIVISION
FIRESTONE PLASTICS CO., DEPT 628J, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

NOW

MINIMUM LEAKAGE PUMPING CORROSIVE SOLUTIONS . . .



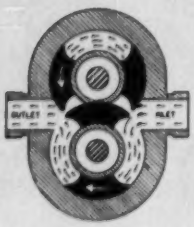
with a Waukesha Pump... using a John Crane Seal



Note, too, these other outstanding pump features to speed plant production and lower operating costs

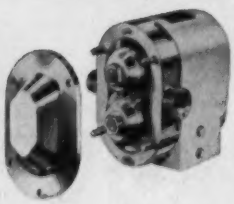
Positive Displacement and Slow Speed

No product damage ...no aeration... no agitation.



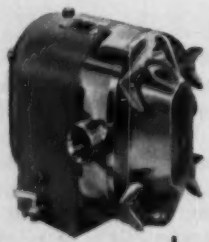
Sturdy Construction

Designed for long life, a minimum of maintenance.



Corrosion-Resistant

No product contamination... no impairment of flavor.



Sanitary

Easy to clean, especially when changing product runs while using the same pump.

● Designed for a "tough" pumping job in the chemical industry, where volatile, corrosive, or hot materials are being transferred, is the Waukesha positive displacement pump with the spring-loaded, John Crane Rotary Seal. Incorporating carbon, ceramic, and teflon, this seal is recommended for non-abrasive products having corrosive properties.

Waukesha positive displacement, corrosion-resistant, stainless steel pumps are renowned for their precision performance and dependable operation in many industries. These pumps require a minimum of time to dismantle, clean and assemble. They are easy to wash and sterilize... a valuable asset where pumps are used to handle various products one after another. Write the Waukesha Foundry Company, Dept. 7P, Waukesha, Wisconsin, for complete details.

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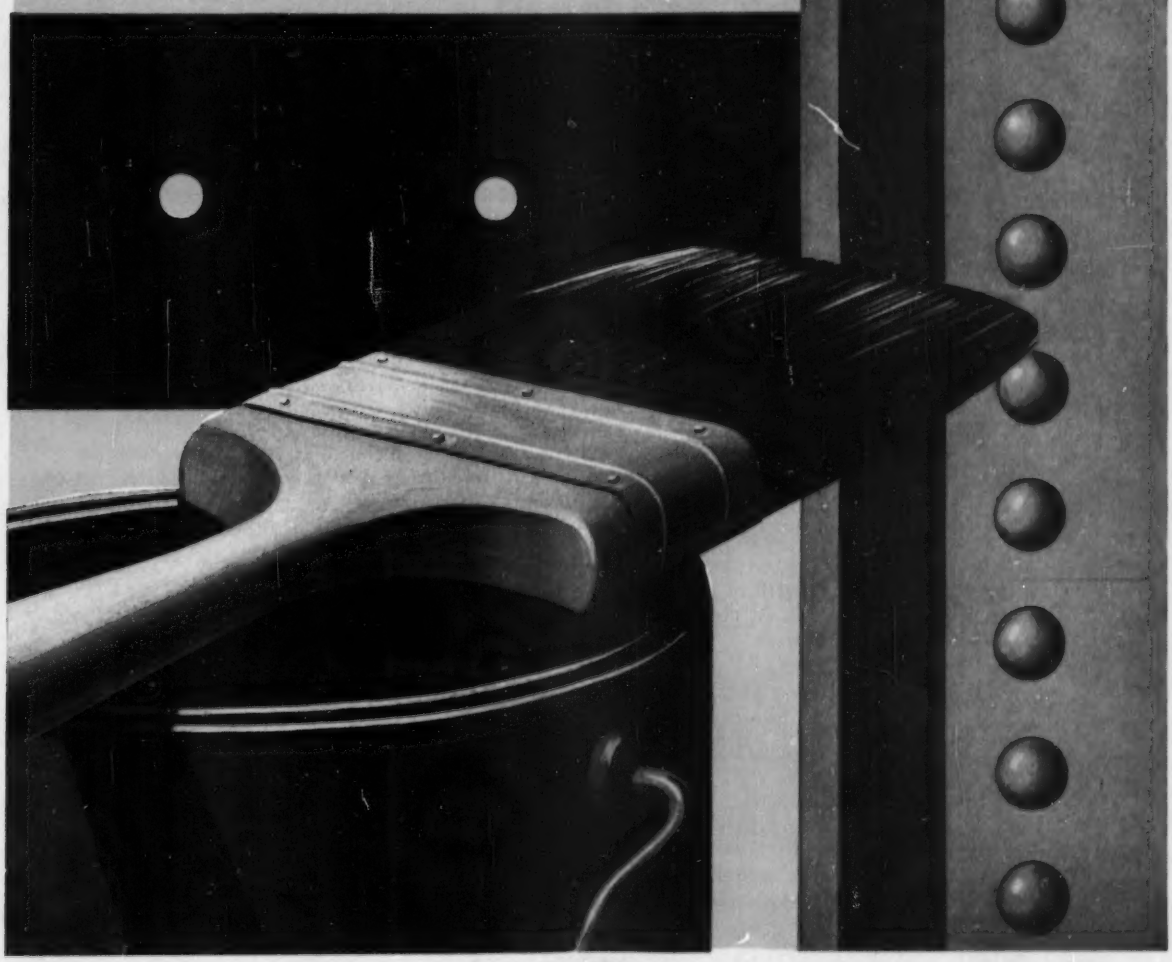
You don't have to pay a lot of money for coatings that provide long-term protection in the most corrosive atmospheres — Barrett Cold Coatings. These high-grade coal-tar coatings are applied by brush or spray without heating or activation. Their properties include chemical resistance, heavy coating thickness per coat, and fast drying. And they are surprisingly economical.

Here are some typical industrial uses of Barrett Cold Coatings: pipes, valves and connections; fences, grates and other open metal work; interiors of potable water tanks; cranes, conveyors and handling equipment. The applications are endless. But the result is always the same—highly effective protection at low cost. Let Barrett help you introduce these economical coatings into your plant maintenance. Write for particulars—prices—literature.



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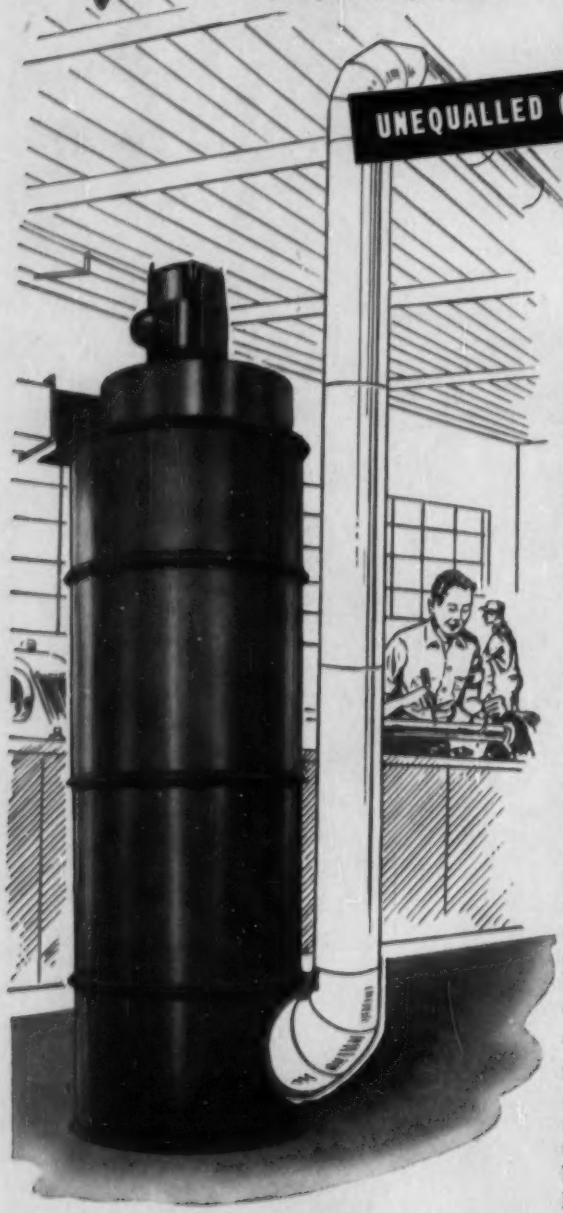

The Cyclonaire is compact and inexpensive . . . yet so efficient it handles big fume removal jobs formerly requiring larger, custom built units. This increased capacity-to-size ratio is due in large degree to Intalox Saddle packing — the "heart" of the Cyclonaire. Intalox Saddles provide more *useful* wetted surface area, greater randomness of packing and a higher percentage of free space through the bed than any other tower packing. Thus fumes are more efficiently scrubbed at high C.F.M. rates, removing up to 99.9% of many gases in concentrations of 1% or less. The Cyclonaire safely handles corrosive gases in low concentrations.

You can order a Cyclonaire in any one of four standard "package" models, in capacities ranging from 750 to 6,000 c.f.m. However, many variations are possible to meet virtually every requirement. For instance:

When 100% fume removal is required, scrubbing action can be increased in any model either by adding additional packed sections or using two Cyclonaire units in series. If additional c.f.m. capacity is needed, two or more standard units can be used in parallel. Where elimination of dust or spray is the only problem, whole packed sections may be omitted or the amount of packing reduced. Where fumes are not soluble in water, absorbent chemical solutions can be employed by using recycling equipment. These are but a few of many variations possible.

The Cyclonaire is constructed of steel in easy-to-assemble flanged sections. Installation takes only a few hours, and it can be disassembled and relocated in a comparably short time. All inner surfaces are protected by a 3/32" thick corrosion-resistant Tygon lining. (The same basic lining that protects pickling and plating tanks.) Exterior surfaces are coated with Tygon ATD Hot Spray.

Write today for Bulletin FW-5 which presents detailed and illustrated technical data.

251-E

PROCESS EQUIPMENT DIVISION

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JULY 1956

· Chementator

H. T. SHARP

√ **Stauffer Chemical now has its new, improved titanium tetrachloride process in semi-commercial production at Niagara Falls, N.Y. Plans for full scale operation are being studied.**

√ **Look for word soon on Humble Oil's plans for its big (30-40 million tons), offshore sulfur deposit. Best bet is that the company will announce that it is going to start mining operations.**

√ **Two new processes skip the sponge step in making titanium metal. The Bureau of Mines (Albany, Ore.) uses low-pressure sodium reduction in a water-cooled steel bomb. Illinois Zinc's new subsidiary Continental Titanium Co. has its new process in final development stages. Details are secret, but the process is called "revolutionary."**

First polypropylene plant set for '57

World's first commercial polypropylene plant will begin operations at the Montecatini Group's Ferrara, Italy, works in the early months of 1957. Initial production will be several tons of polymer per day. Most of this will go into molded products, although film will be made too. Production of polypropylene fibers is also in the offing.

The new plastic (*Chementator*, March 1956, p. 103) features a crystalline structure that gives it a high melting point (320 F.), high tensile strength (the fiber is stronger than nylon) greater resistance to solvents and none of the waxy feel of polyethylene. Made from relatively cheap proplyene, the material will compete with both polyethylene and polystyrene for markets. In fact, Montecatini plans to price its product at 43-45¢/lb., about the same as polyethylene currently sells for in Italy.

Developed by Guilio Natta at Milan Polytechnic Institute (working under a grant from Montecatini) and based in part on Karl Ziegler's work (*see below*), the new polymer is an isotactic. Each of its monomer units has the same steric configuration of the asymmetric carbon atoms.

Natta's still-secret heterogeneous, anionic catalysts—believed to be a series of metal alkyl-metal halide complexes — direct the growth of the polymer into a spiral pattern of alternating CH_2 and CHR groups.

In New York, enroute to the Gordon Research Conferences in New Hampshire, Natta noted that the physical properties of these catalysts, not their chemical nature, control the stereo-isomeric nature of the polymers.

This oriented polymerization has also been tried on other alphaolefins and diolefins (up to and including C_{10}) as well as styrene. Right now, these are far from commercialization, but isotactical polystyrene and polybutadiene have impressive market potential. Lab batches of polystyrene melt at 445 F., much higher than ordinary polystyrene.

Over 30 U. S. chemical makers are re-

ported to have contacted Montecatini to arrange for licensing. While no licenses have been granted to date, the current two-months stay of Montecatini's managing director, Piero Giustiniani, in this country leads observers to think an announcement may be near.

Many U. S. firms are known to be working on polypropylene on their own. Phillips Oil, for example, has made the polymer through its low pressure polyolefin process (*Chementator*, June 1955, p. 103). But this material is believed to lack the isotactic structure of Natta's.

Standard Oil of Indiana claims to have produced isotactic polymers of propylene in its Whiting (Ill.) labs. Propylene is also mentioned as a possible starting material for Standard's low pressure polymerization process (*Chementator*, March 1956, p. 103) in the process patent (U. S. 2,692,257). But the characteristics of Standard's material appear to differ somewhat from Natta's. Melting point and tensile strength are said to be lower.

Texas Eastman has just received a license to commercialize Standard's process.

Ziegler develops new process for TEL

Meat packers who boast that they use everything from the pig except the squeal, should take a look at the way Germany's Karl Ziegler is letting none of the work on his new low-pressure polymerization process (*Chementator*, Jan. 1956, p. 104) go to waste.

The process was originally developed to make polyethyiene, but the techniques have since been used to make other polyolefins, notably polypropylene (*Chementator*, Mar. 1956, p. 103). Now the catalyst in the process, triethylaluminum, is being used as the raw material in a Ziegler-developed electrolytic cell for tetraethyl lead.

Ziegler reacts aluminum directly with ethylene and hydrogen to make the triethylaluminum.* Incorporated into a complex sodium fluoride salt, this forms the electrolyte in the new TEL cells. These cells have lead anodes and electrolysis produces TEL on the anode surface. Heavier than the electrolyte, the TEL collects at the bottom of the cell. A byproduct is 99.99%-pure aluminum.

Although at least four U. S. chemical companies are reported to have studied the new process, there seems to be little chance of any using it commercially until a substantial amount of development work has been done. Both DuPont and Ethyl, current TEL producers, are among those who've examined Ziegler's work, but both are sticking to the conventional sodium process in their new TEL plants, DuPont at Antioch, Calif., and Ethyl's Canadian subsidiary at Sarnia, Ont. (Ethyl has also optioned plant sites for possible TEL production, via the sodium process, at both Antioch, Calif., and Joliet, Ill.)

Stepan Chemical, Chicago, also looked at the process, but backed away from it because of the amount of development needed. Stepan then turned to a sodium process owned by Germany's Friedrich Uhde Corp., but now it has decided not to enter TEL production at all.

Any new TEL maker would appear to need a process which would give him a big cost advantage over the conventional process. The high development price of the Ziegler method will be a handicap, but the process is one you'll likely be hearing more about.

* An earlier process (U. S. 2,744,127) reacted an aluminum-magnesium alloy with ethyl chloride. Ziegler-licensee Hercules Powder is studying the new process in the lab.

Nuclear wastes may turn profit makers

Despite Atomic Energy Commission prodding, chemical firms have been dragging their feet in providing the spent reactor fuel reprocessing facilities that AEC says will be needed for future atomic power plants.

AEC would like to see a reprocessing plant set up and ready to run by the time the first of these power plants begins producing its spent fuel byproduct. And it expects to ask for proposals from private firms in a little over a year. To help interested companies prepare their proposals, AEC has invited them to several meetings and given them a peek at classified technical and economic data.

Main reason for flagging interest on the part of chemical companies is the high cost, low-profit outlook for these operations in the immediate future. It'll be at least 1967 before there'll be enough private nuclear reactors to keep a reprocessing plant running at the high load factor necessary for profitable operation.

Some observers cite another deterent. They point to current research in the use of fission products and predict that in the future these will move from the waste into the wanted category. Just as one-time petroleum refining and wood pulping wastes have been turned into profitable products, fission wastes

(Continued on page 112)

Another client benefits from a BMC "Precious Plus"

Esso Unit Completed ... 21 days early!

To meet urgent production needs, a quick, quality job was desired on construction of a new process unit at an Esso Standard Oil Company refinery.

BMC Engineering accepted the challenge . . . and with a Key Man* in charge, put the unit on stream — at full capacity — *twenty-one precious days ahead of schedule!*

Speed was the need — with efficiency, of course. This was the "Precious Plus" in BMC's performance which never can be shown on blueprints — for it is the product of many intangibles. Other leading companies, too, find BMC's *plus* in performance of *precious* advantage. How else explain the unusual growth BMC is enjoying?

You need new "yardsticks" to measure the *plus* performance of BMC. For the abilities of this dynamic organization go far beyond what can be shown on blueprints — and it's such intangibles that add up to better plants, faster and at lower cost.

. . . whether your process problem is common or complex. BMC engineers solve it with "fresh" thinking that frequently produces *new* efficiencies, *unexpected* savings.

. . . BMC Engineers are *more* than competent — most staff members are recognized *authorities* in their fields.

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Look What's Happened to Classification...

Wet classification—important unit operation throughout the process industries—demands special equipment and a wide range of designs. Typical of this trend to specialization is the new, ultra-modern phosphate rock washing plant of Armour Fertilizer Works near Bartow, Florida. No less than nineteen individual Dorr "Classifiers" of five radically different designs are being used for size separation.

1 A Dorr Classifier, upper left, makes a 65 mesh separation with rake product capacity of 240 long tons per hour splitting to two 16½- pocket Dorrco Jet Sizers for further classification ahead of screens.

2 Combined overflow from Classifier and Sizers is treated in this 50' dia. Dorr Type H-1 Hydroseparator.

4 High capacity Dorr Type AX Hydroseparator handles flotation concentrates prior to further treatment.

3 Desliming at 150 mesh is accomplished in fourteen 24" dia. DorrClone Separators equipped with Vactrol control devices. Units respond automatically to changes in feed . . . produce uniform underflow at 70-75% solids.

Dorr-Oliver is the only manufacturer of a complete line of wet classification equipment. When you call on Dorr-Oliver you can be sure you'll get an unbiased recommendation . . . the *right* equipment to solve your particular classification problem.

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will perhaps be too important to be reprocessed and disposed of.

They look to the day when some reactor facilities will be designed principally to produce fission products for the many applications now being uncovered (*Chementator*, Feb. 1956, p. 105 and Mar. 1956, p. 103)—and the need for reprocessing facilities will be far less acute.

Shell's new reactor has a cousin

Operating details of Shell Oil's new riser reactor (p. 120) had hardly been revealed before chemical engineers in the oil industry started comparing it with what's known about the "transfer line reactor" that Humble Oil has been using since 1952.

Essentially, Shell's unit is a vertical pipe (diameter not revealed) in which fluidized silica-alumina catalyst and vaporized crude oil flow concurrently upward at 900-1,000 F. Humble's is believed to use a horizontal pipe about three feet in diameter in which catalyst and oil flow at undisclosed temperatures.

Major difference, aside from positioning, appears to be in the way the units are used. Shell's is the initial cracking stage of a multi-stage, integrated operation. Uncracked components are removed from first-stage products for cracking later at more severe operating conditions. Humble, apparently, does its cracking in only one stage.

In addition, Humble's reactor was built to solve a particular problem in a specific situation. Shell, on the other hand, claims that its technique has been worked out to meet all types of cracking situations. And Shell says that it now has the know-how needed to design the most economical, multi-stage, integrated unit to solve any cracking problem.

Add a pinch of salt, boost ClO_2 yield

Olin-Mathieson's just-announced improvement to the Mathieson process for chlorine dioxide may produce savings of $8,000 a year per ton-day for pulping mill operators.

Currently, mill operators generate their chlorine dioxide for pulp bleaching (See earlier story on growth of ClO_2 bleaching on p. 134) by reducing sodium chlorate with sulfur dioxide or methanol in an acid medium. Depending on the process used, yields vary from about 85 to 90%. Chemical costs run about 17.3¢/lb. of chlorine dioxide.

O-M claims that by simply adding sodium chloride (0.06-0.08 lb./lb. of sodium chlorate) to the reaction mixture, yields jump to about 97% of theoretical, free chlorine content of the generated gas drops from 2 to 5% to less than 1.5%, the amount of chlorate lost in waste reaction liquor is reduced and chemical costs drop to 16.2¢/lb. of ClO_2.

Chloride injection represses a side reaction of the chlorate by substituting the added sodium chloride for that now formed in small quantities during reduction of the chlorate. This permits the chlorate to go almost entirely to chlorine dioxide.

The process was proved successful in a full-scale plant trial at the Covington, Va., mill of West Virginia Pulp & Paper. Olin Mathieson plans to make its patents available to all mills for royalty-free use.

Pennsalt improves sodium chlorate cells

Also concerned with chlorine dioxide bleaching (*see above*), Pennsylvania Salt Mfg. Co. has announced an improved electrolytic cell for making sodium chlorate, the essential raw material for ClO_2 generation.

First installation of the new cells will be at the company's Portland, Ore., plant where a complete bank will be put into commercial operation by early next year.

Details of the improvement are being kept under wraps until the full scale trial proves successful and its new patents issue.

Army makes decontaminant new way

Chemical engineers at the Army Chemical Center, Edgewood, Md., are now supervising designs for a unit plant to use a new process for making the gas decontaminant, supertropical bleach, or simply STB, an important safeguard in event of gas warfare.

Supertropical bleach is so-called because it is so stabilized it remains effective even under the most diverse climatic conditions. Chemically, it's an intimate blend of chlorinated lime of a specific available chlorine range and finely ground quicklime. The latter stabilizes the product through its ability to react with any free or formed water.

In its new process, the Army reacts counter-current streams of hydrated lime and chlorine gas at 120 to 170 F. in three horizontal troughs, in series. Stacked one above

(Continued on page 114)

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the other and connected by chutes, each unit is 30 in. in diameter and 20 ft. long, and operates under slight vacuum. A ribbon mixer in each trough assures a dynamic and positive contact between the solid and gas phases.

The Chemical Corps calls the process predictable, easy to control and highly efficient in its use of chlorine. Total retention time is only 80-90 min.—compared to 6-8 hr. in the prior process.

The older process reacted the materials in slowly rotating, steel cylinders, 3 ft. in diameter and 90 ft. long, in which the solids were moved slowly by means of flites and in which gas-solid contact was quite uneven.

Shell plans to make DAP on West Coast

Shell Chemical Corp., long-time producer of ammonia and ammonium sulfate, is now heading for full-scale production of diammonium phosphate. Behind the move are a growing demand for phosphate fertilizers in western states and expectations of a glut in ammonia supplies by 1957.

Shell's decision to produce some 5,000 tons of DAP this year is part of a product diversification program that already includes a 150-tons/day urea plant now nearing completion at Ventura, Calif. It fits in with three current trends in fertilizer use—high analysis products, pelletization, custom-formulation.

Production of DAP will be closely tied to present ammonium sulfate production at Pittsburg, Calif. Both products, in fact, will be made in the same facilities. And since mixing DAP and ammonium sulfate gives a wide range of nitrogen-phosphorous ratios, formulators will be urged to base their blends on Shell's new one-two punch.

A 400-ton marketing run last fall convinced Shell that DAP's sales potential is finally ready to be tapped. Two years ago Best Fertilizers, Oakland, Calif., made several hundred tons of the material, but depressed price levels soon cooled Best's interest. Colorado Fuel & Iron, which markets most of its DAP in the Midwest, ran into the same trouble in trying to establish its product in the west. But the market tone has changed and it is now reported to be quoting three-month delivery times.

At Pittsburg, Shell reacts ammonia with either sulfuric or electric furnace phosphoric acid in a crystallizer-evaporator held under a slight vacuum. Reaction heat drives off the water and the resulting crystals are centrifuged, dried and packaged.

When making DAP, the crystallizer-evaporator and the dryers have to be held at lower temperatures since DAP decomposes to mono-ammonium phosphate at 360-390 F. (compared to ammonium sulfate's decomposition at about 960 F.). And phosphoric acid's higher corrosion rate is a problem.

Importantly, Shell feels that its process could be modified to use wet process phosphoric acid. Iron and aluminum impurities in this grade form hydroxide gels which cause gumming troubles. Shell thinks it can get around these troubles, but with three handy sources of the higher purity acid and higher freight charges on wet process acid, it has little incentive.

Workers' pay up about 6%

Workers in most chemical and petroleum plants this year are earning about 6% more than last year.

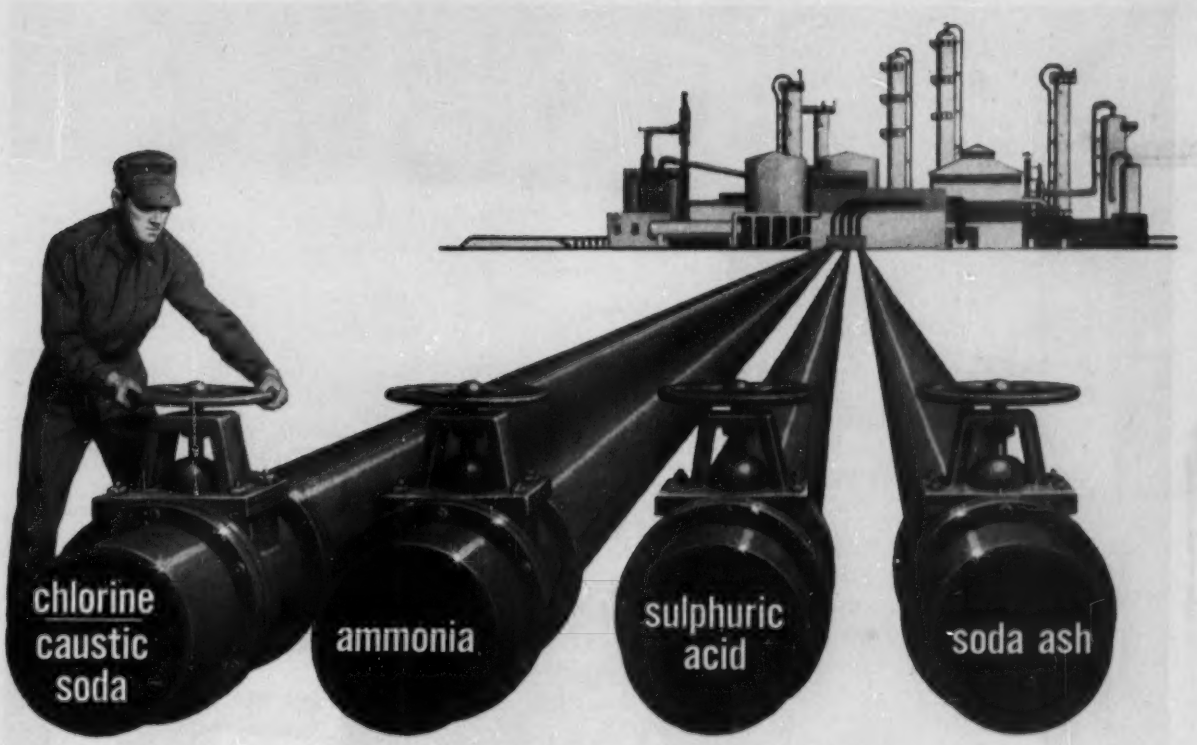
The 6% pattern was pretty firmly established early in the year in a slew of oil industry contracts. And chemical firms, particularly those in oil centers, have also stuck fairly close to the 6% pattern. An example is the recent settlement involving some 19,000 paper mill workers in the far west.

Away from oil industry concentrations the pattern is not so rigid. In the south, for instance, a comparable group of paper mill employees accepted a 5% boost.

In Canada, where the Oil, Chemical and Atomic Workers Union recently adopted a policy of trying to close the gap between rates paid oil workers and those paid chemical workers, chemical wage settlements have hovered around a 6½% increase.

Meanwhile, labor appears to be having a rough time trying to make good on boosts to enlarge its holdings in the chemical industry (*Chem. Eng.*, April 1955, p. 167). Chief difficulties appear to be jurisdictional troubles (which union gets exclusive rights to organize which companies or plants), the nature of the industry (in terms of the number of production workers employed, most chemical plants are small and pretty well scattered) and worker contentment (compared to industry in general, oil and chemical workers are well paid and enjoy many benefits).

For more of WHAT'S HAPPENING.....117



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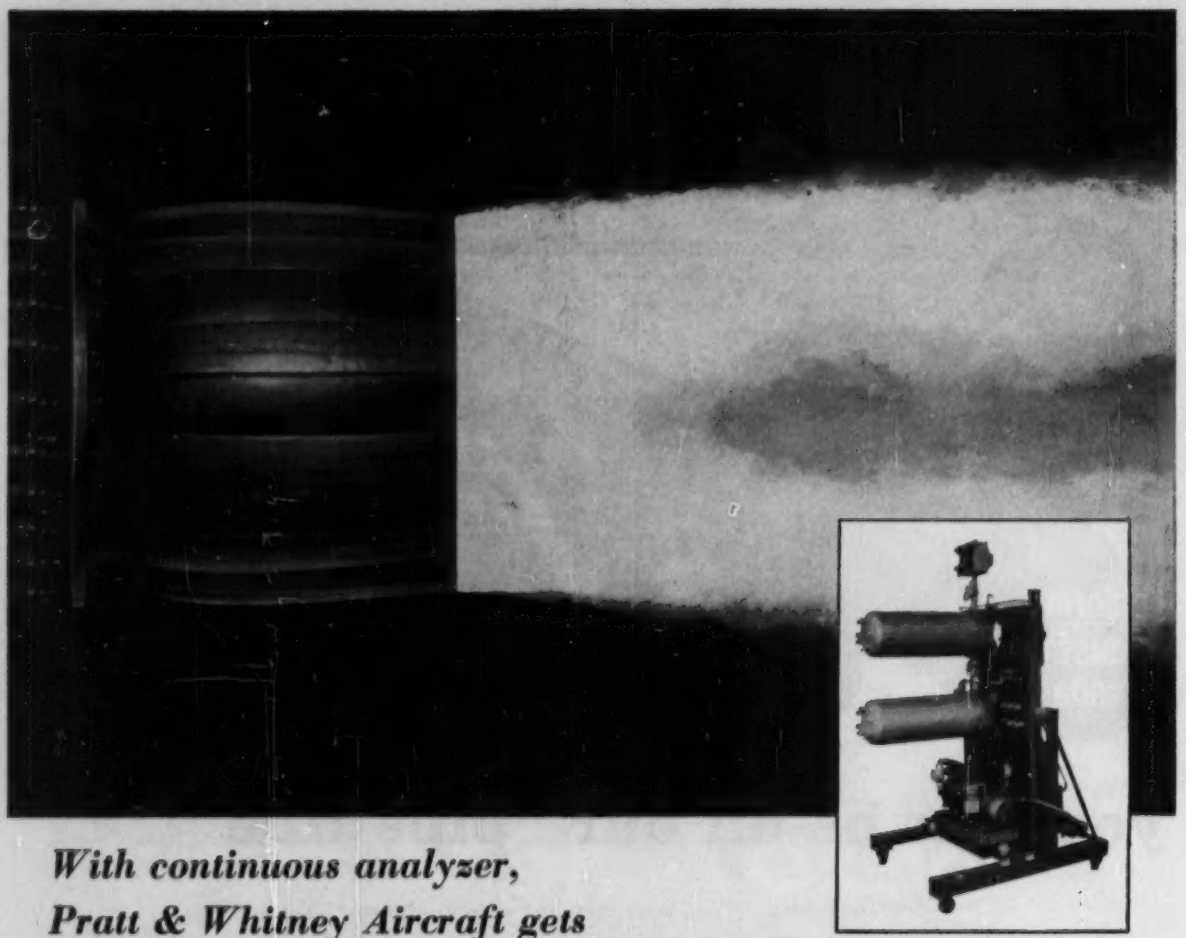

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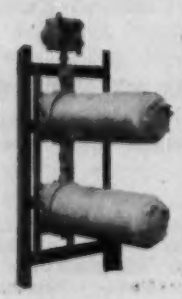

P-E TRI-NON Analyzers are available in a wide range of models and prices to meet all types of continuous analytical problems. They are rugged and dependable, expressly designed for use in the varied environments of a processing plant or refinery. For quick and easy maintenance, instrument components can be tested right on stream — without disconnecting.

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Norwalk, Connecticut

What's Happening

JULY 1956 FEATURE NEWS

- **New Ammonia Plant Is Shrunk to Fit** 119

  Westvaco had hydrogen to burn, but little space to spare at its South Charleston plant. Engineers designed new unit to use last foot of each.

- **Two-Stage Cracking Gives High Yields** 120

  Addition of first-stage "riser reactor" to Shell's fluid-bed unit minimizes under- and overcracking.

- **Vinyl Foam Process Finds Many Takers** 122

  Six licensees of Elastomer Chemical Corp.'s new mechanical foaming process are already in production. More than 25 additional ones may be joining them soon.

- **Purify While They Cool** 128

  Sun Oil gets double duty from its cooling towers by using them as biological filters to control water pollution at its Toledo refinery.

- **New Plant Uses Na Reduction for Ti** 130

  Electromet gets $TiCl_4$ from Columbia-Southern, sodium from National Distillers; reciprocates with raw materials.

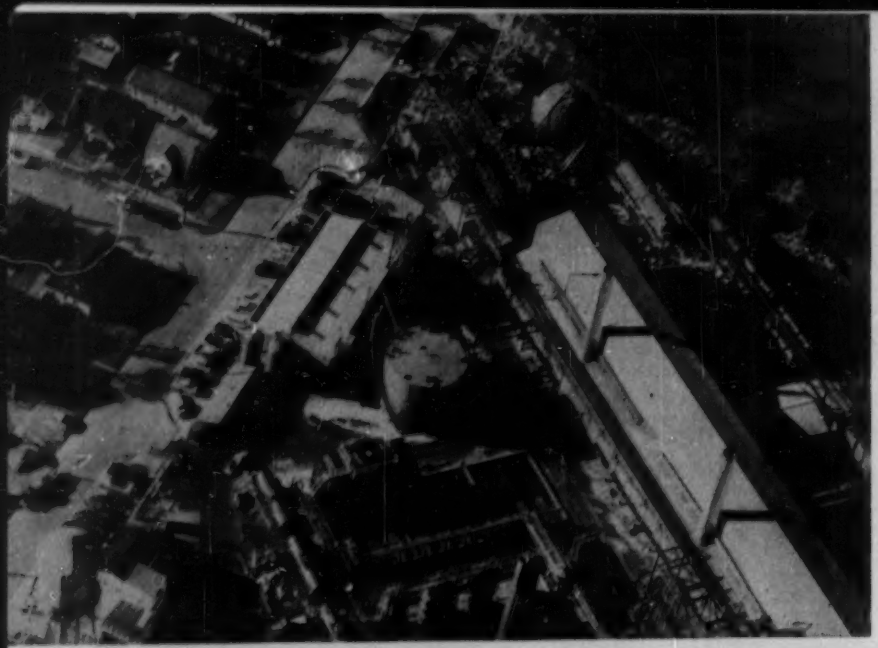
- **Pulpers Switch to Dioxide** 134

  Development of practical processes for generation of chlorine dioxide at point of use has triggered a rush to cash in on its desirable bleaching properties.

- **Coming: Medium-Temperature Carbonization** ... 138

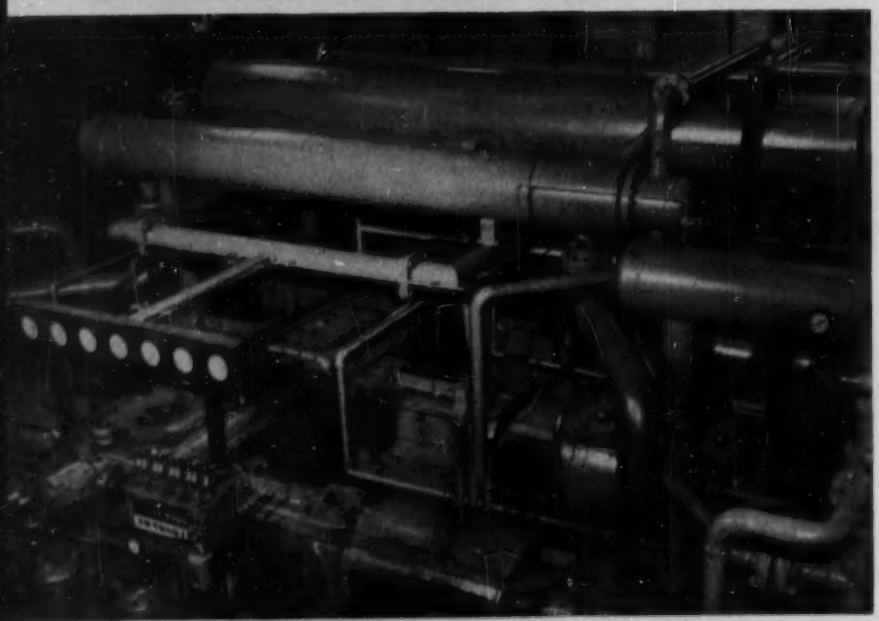
  New process emphasizes production of char, rather than chemicals, from low-grade Western coals. Output from new plant will help make nonferrous metals.

- **Convention Calendar** 132

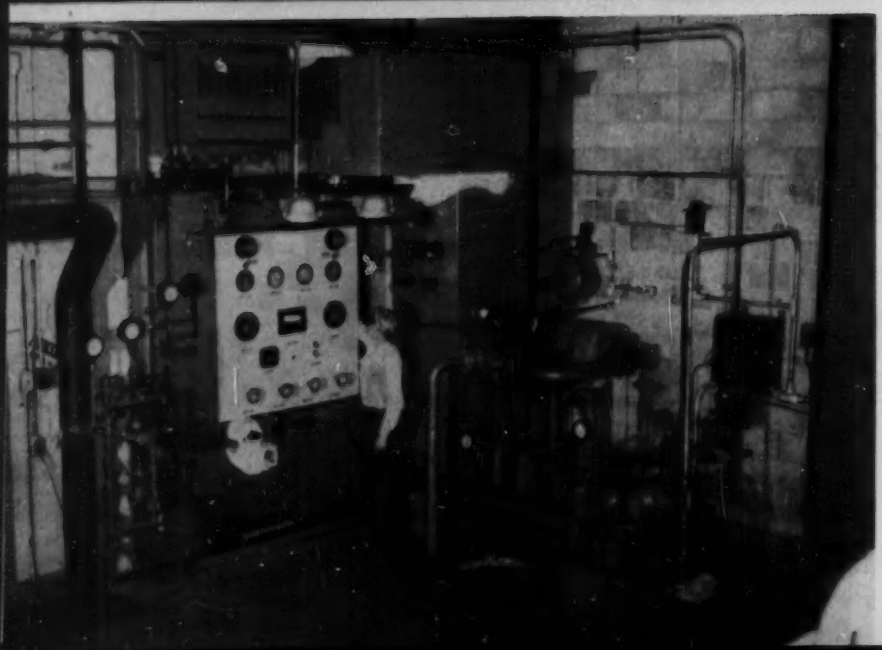


No Elbow Room Here

Inelastic space limitations at Westvaco's S. Charleston site can be seen in the view at the left. Northern boundary is the Kanawha River. West and south is a city street. To the east is a carbon bisulfide production unit and other manufacturing facilities. Small triangular area was the only spot available for the ammonia plant.



Single, large units of equipment, such as this 2,500-hp., six-stage synthesis gas compressor, take up less room than smaller multiple units. Plant uses only half the conventional number of instruments. Such economies saved money as well as space, with no sacrifice in ease of maintenance or operation. Two operators per shift run the process.



Air-separation unit (control panel and turbo-expander are visible in photo) provides nitrogen for ammonia synthesis; hydrogen comes from electrolytic chlorine-caustic cells. The two gases are mixed in the proper ratio and pass through a single gasholder, which smooths out variations in hydrogen supply due to chlorine cell shutdowns.

New Ammonia Plant Is Shrunk to Fit

Westvaco had hydrogen to burn, but little space to spare at its South Charleston plant. Engineers designed new unit to use last foot of each.

It took some skillful engineering to shoehorn Westvaco Chlor-Alkali Div.'s new ammonia plant safely into its tight corner at S. Charleston, W. Va., especially with a residential community within spitting distance of this —at least popularly regarded— touchy chemical process.

Aimed at exploiting byproduct hydrogen from Westvaco's adjacent 400-ton/day chlorine-caustic operation, the 60-ton/day package was squeezed into a ground area 10-20% smaller than that considered normal by contractor Lummus. Air Products wedged an air-separation plant onto the site to supply the nitrogen fraction of the synthesis gas.

Westvaco's well considered design paid off with an extra bonus —plant cost was sliced by 20%. At $1,900,000, Chief Engineer Howard Sommers figures the company saved $450,000 over the cost of a conventional plant.

▶**Every Inch Counts**—To pull off this neat engineering feat Sommers' team reached for every known good design practice— and then invented some more. Knowing the maximum hydrogen feed from the chlorine plant, they designed—down to the last cubic foot—for the exact ammonia equivalent.

As Sommers puts it, "Often engineers calculate one size, then install a size larger to make sure that it will handle all possibilities. When we specified a size, the minimum possible, we stuck with it, confident of our careful engineering. We didn't have room for extra steel."

Every piece of equipment was evaluated to see if it could be eliminated or tied in with another. One space-saver: Westvaco's use of a single 40,000-cu. ft. gasholder to store mixed synthesis gas.

By metering the hydrogen and nitrogen streams directly from their sources in the 3:1 ratio, Westvaco dispensed with the usual hydrogen gasholder. And only the sporadic hydrogen feed, due to intermittent chlorine cell shutdowns, prevented Westvaco from throwing away the mixed gasholder as well.

▶**Just Enough Instruments**—A look around convinced Westvaco that most ammonia plants overload themselves with instruments. Sommers' team combined the function of many, fully utilized all, eliminated some entirely and wound up by halving the number of instruments required at S. Charleston. Example: Hydrogen flowmeter also measures air concentration in hydrogen stream, signals when air overshoots safe level.

And Westvaco's favored design philosophy (see *Chem. Eng.*, May 1956, p. 114)—that the advantages gained from single, large units outweigh the operational security of smaller, multiple units—was applied effectively in the drive on waste space. For, in addition, single, large units take up less room.

Selected: One 2,500-hp., six-stage synthesis gas compressor, one 400-hp. circulator, one 400-hp. air compressor in the liquid air plant.

▶**Good Design Means Safety**—Compact of necessity, the plant is also easily maintained and operated. Two operators per shift run the entire process.

Key to its high degree of safety stems from its ease of maintenance. Sommers explains, "Well designed, diligently inspected and maintained, an ammonia plant is actually no more hazardous than many other chemical processes. At our installation we can get to every piece of equipment to check for leaks, corrosion and failures, thus prevent dangerous conditions from developing. And we have incorporated the most advanced safety devices."

As an added consideration to its neighbors Westvaco laid out the plant so that the community sees only a handsome glass-and-brick building. Most all the "gingerbread" has been hidden behind it.

▶**How It Works**—Plant operates basically on the Haber process. Synthesis gas, compressed to 5,000 psi., passes through four filters which remove compressor lube oil from the gas stream. Water-cooled exchangers drop the temperature of the gas to around 75 F.

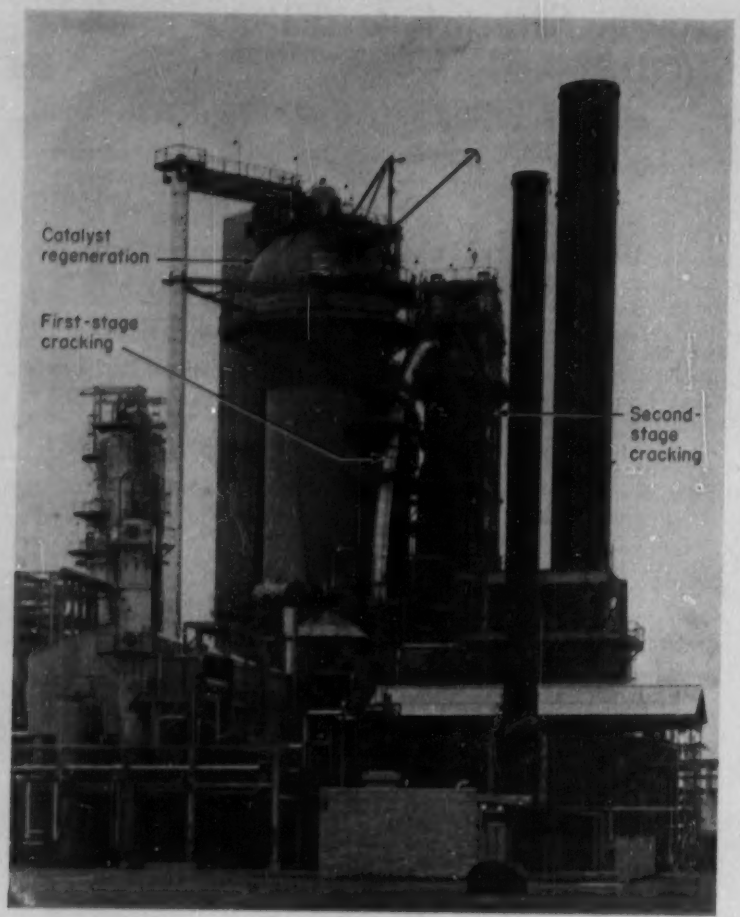
Iron catalyst reactor converts 15 to 16% of the synthesis gas to ammonia. Housed in top-strength multilayer shell, it operates at 900 F.

Ammonia is condensed from the converter product. Unconverted mixed gas circulates back to the feed, while the ammonia is piped to a 500-ton spherical storage tank.

▶**Why Liquid Air** — Westvaco rejected burning air with hydrogen as a cheap nitrogen source because that process loses 16% of the valuable hydrogen to water. This would represent too great a bite out of the plant's limited hydrogen supply. Equivalent ammonia produced and sold from the "not-lost" hydrogen pays off the nitrogen plant, Sommers reports.

Though anhydrous ammonia is the main product—for all but refrigeration uses — Westvaco markets a small quantity of aqua ammonia. Shipped by tank car, 50% of the anhydrous product goes to nearby Carbide and Carbon Chemicals Co.

Westvaco may have come up with the prototype of small, compact ammonia plants which could be strategically located throughout the country at sources of hydrogen, natural gas or fuel oil. With ammonia costly to transport, many such units, serving limited local areas, would eliminate the present practice of shipping ammonia from large plants to more distant markets.



Two-Stage Cracking Gives High Yields

Addition of first-stage "riser reactor" to Shell's fluid-bed unit minimizes under- and overcracking.

Although the two-stage fluid catalytic cracker pictured above has been in operation at Shell Oil's Anacortes, Wash., refinery since January, the company waited until May's American Petroleum Institute meeting to tell how it works.

A new short-contact-time, high-temperature "riser reactor" is its novel feature. Used in the initial cracking stage, this is said to permit a high degree of operating flexibility, minimize overcracking/undercracking losses and also to give high yields of premium-quantity gasoline.

▶ **How It Works**—At Anacortes, Shell charges 23,000 bpd. of Alberta crude to the unit, along with regenerated silica-alumina catalyst. In the first-stage reactor, which is essentially a vertical pipe, fluidized catalyst and vaporized feed flow concurrently upward at 900-1,000 F. Despite these high temperatures, in the short total contact time—only a few seconds—there is relatively little coke deposited on the catalyst and the gasoline made isn't destroyed by secondary cracking reactions.

Reactor products and catalyst are separated in high-capacity cyclones. Catalyst goes to a second-stage, dense-bed reactor, while the products go to a fractionator. Gas oil from this fractionator feeds the second-stage, fluid-bed reactor.

Spent catalyst from the fluid bed is stripped, regenerated and recycled to the riser reactor.

▶ **Results** — Total conversion runs over 75% with the crude used at Anacortes.

Gasoline made by this method has a higher olefin and lower aromatic content than that from a conventional single-stage process. It also has a somewhat higher sulfur content. While this is no problem with most crudes in the United States, high-sulfur crudes will need special techniques.

▶ **Flexibility** — Ability to vary conditions in the two cracking stages permits wide operating flexibility. Production of either gasoline or intermediates can be maximized.

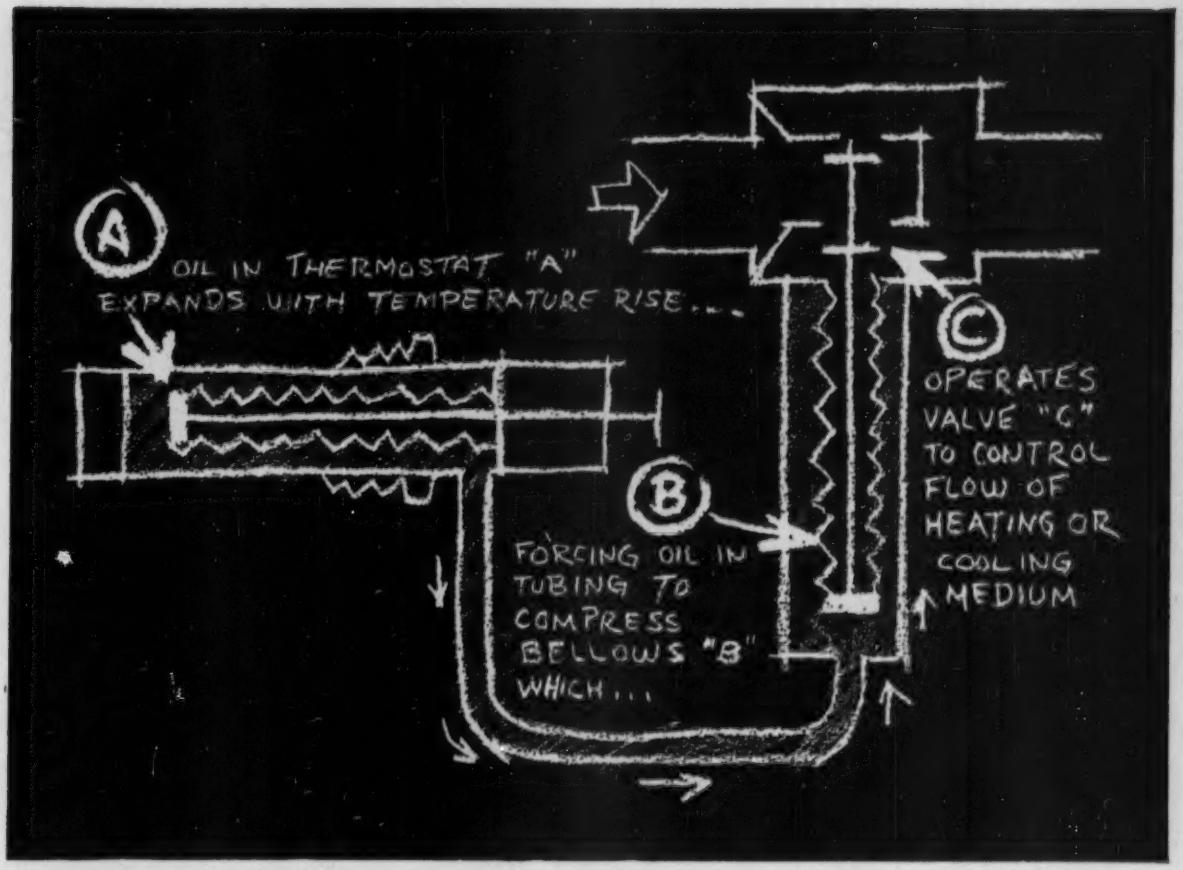
Shell points out that gasoline yield can be boosted by recycling at one of the cracking stages. And the yield of light gas oil could be raised by charging only heavy gas oil to the second stage.

The process can be adapted to existing fluid units, in some cases, simply by adding the riser reactor and auxiliaries.

Three New Plants For Sulfuric Span Nation

Coast-to-coast slate of new sulfuric plants has been announced: In Elizabeth, N. J., General Chemical Div. will build a sulfuric acid unit whose supplies and market will be furnished by Esso's Bayway refinery. In Chicago, the same firm will complete a stabilized sulfuric anhydride plant by the end of the year. And in Dominguez, Calif., Stauffer Chemical Co. has started construction on a $2-million sulfuric acid unit.

Stauffer also plans to expand and modernize its Niagara Falls, N. Y., plant to the tune of $1 million. About $400,000 will go toward a new 73% caustic soda unit; $150,000 will be spent to increase output of chlorinated solvents. The rest will be spent on existing plants for chlorine, caustic soda, titanium tetrachloride, silicon tetrachloride and zirconium tetrachloride.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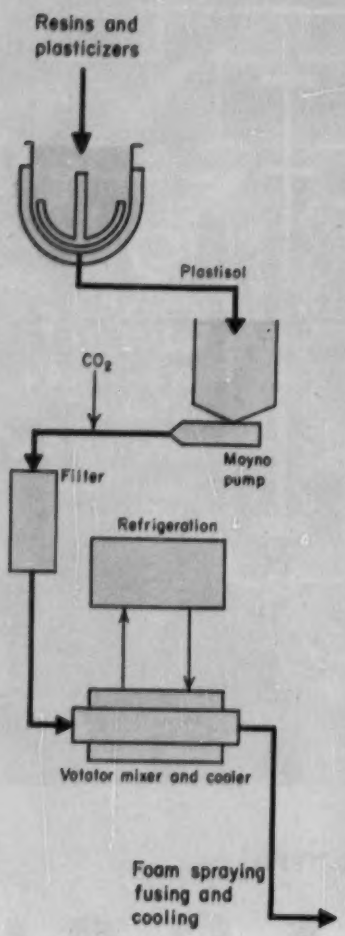
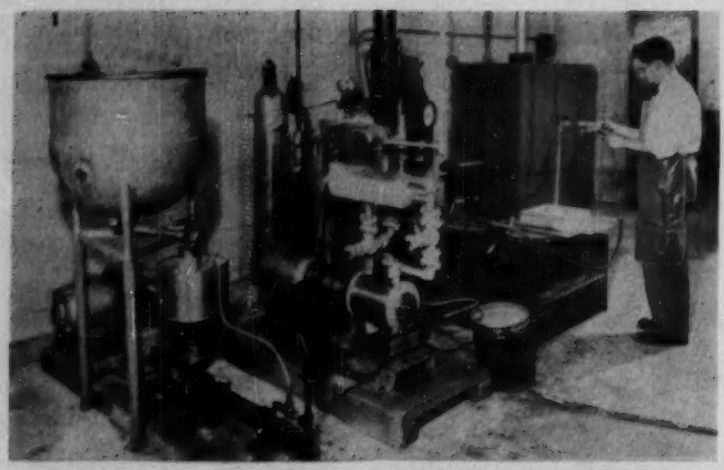




Vinyl Foam Process Finds Many Takers

Six licensees of Elastomer Chemical Corp.'s new mechanical foaming process are already in production. More than 25 additional ones may be joining them soon.

Doing what comes naturally yourself and letting others do the jobs they are best fitted for is a good business policy. It has proved to be a profitable one for Elastomer Chemical Corp., Newark, N. J.

In less than four years this small, enterprising specialty chemical company has parlayed its clever process for mechanical manufacture of open-cell vinyl foam into a busy licensing network that numbers more than 30 companies here and abroad.*

Elastomer Chemical supplies the basic know-how, its licensees the manufacturing and merchandising facilities.

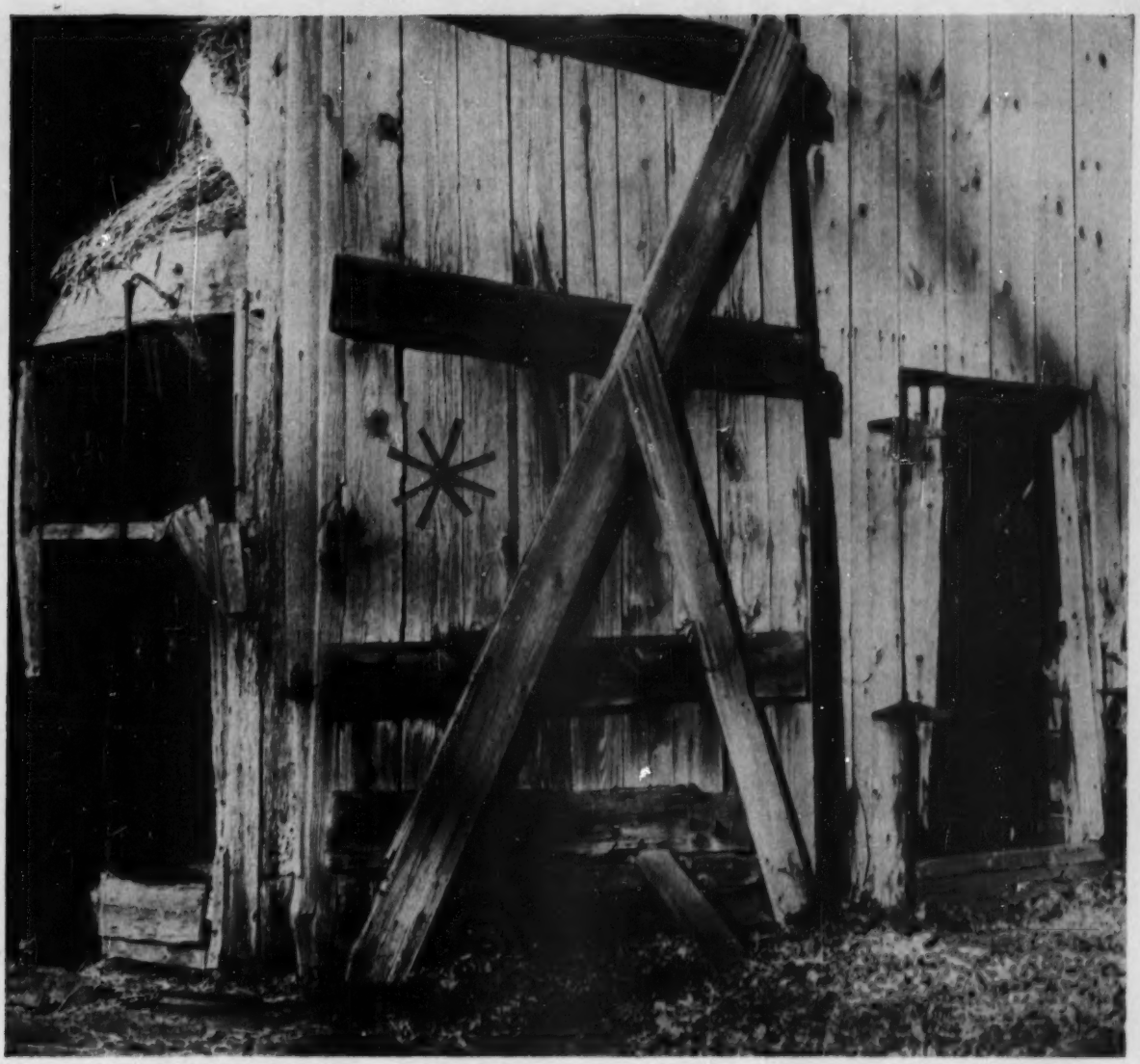
Eighteen U. S. firms—including all the major rubber companies—and ten foreign firms are licensed to produce vinyl foam via the Elastomer process. Six other companies have contracted for licenses to do experimental work on the product and the process.

▶ **Coming Fast** — Since Brown Rubber swung into commercial production of vinyl foam by the Elastomer method a scant 18 months ago, five other licensees have done the same (*see p.* 124).

Elastomer Chemical estimates total output of vinyl foam from its six on-stream licensees has

* Mechanical foaming employs absorption under pressure of an inert gas in a vinyl plastisol (a dispersion of vinyl resin in a plasticiser). Chemical foaming, in contrast, employs thermally sensitive chemical blowing agents.

Open-cell vinyl foam contains interconnecting voids; it is the flexible type used for molded furniture, transportation seating and electronic heat-sealing. Closed-cell foam contains separate, discrete voids; it goes into insulation, marine floats, etc.



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Making vinyl foam now		Vinyl Foam Capacity, Million Lb./Yr.	Other Foam Products
Brown Rubber Co.	Lafayette, Ind.	6.0	S
L. E. Carpenter & Co.	Wharton, N. J.	2.5	
General Tire & Rubber Co.	Lawrence, Mass.	2.5	U
Goodyear Tire & Rubber Co.	Akron, Ohio	0.5	L, S, U
Great American Industries	Bedford, Va.	1.5	S
U. S. Rubber Co.	Mishawaka, Ind.	0.75	L, S, U
On stream by 1957			
Cambridge Rubber	Taneytown, Md.	2.5	
Federal Leather	Belleville, N. J.	2.5	
Kyfoam	Louisville, Ky.	0.5	
Sun Rubber	Barberton, Ohio	0.25	
Firestone Tire & Rubber	Akron, Ohio	0.5	L, S, U
B. F. Goodrich	Shelton, Conn.	0.5	L, S, U
Hood Sponge Rubber	Chicago, Ill.	0.25	S
Nopco Chemical	Harrison, N. J.	2.5	U
Seiberling Rubber	Akron, Ohio	0.25	S

* L = Latex foam rubber; S = Sponge rubber; U = Urethane foam.

reached a rate of 5 million lb./yr. What's even more significant, perhaps, is that these six producers have a total annual capacity of nearly 14 million lb. of the stuff. And other licensees—with a combined annual capacity of 10 million lb. of foam—should be producing by the end of 1956.

In terms of dollars and cents, the current surge of Elastomer-blown vinyl foam figures this way: Total sales last year of $2-3 million, double that in 1956, and annual sales—based on expected available capacity—of $25 million within two years.

▶ **The Tab**—To realize these and future sales, the licensees have already sunk about $2 million dollars (half for development, half for equipment) in the Elastomer process (exclusive of licensing fees) and plan another $0.5 million by 1957.

What's in it for Elastomer Chemical, which itself doesn't produce a pound of foam for sale? Fees of up to $15,000 from each licensee, plus royalty payments at 1-3% of sales of vinyl foam articles or 1-3¢/lb. on vinyl foam incorporated in end products.

For this, Elastomer shows how to make the process click, promotes vinyl foam and provides pilot-plant facilities.

▶ **How Process Works** — Heart of the Elastomer process is the continuous foaming equipment, which meters a vinyl plastisol and an inert gas (usually CO_2) accurately, simultaneously and under pressure; mixes and cools the two; and continuously discharges foam into open or closed molds or onto a conveyor belt.

The foamed vinyl is rapidly and continuously cured in high-frequency dielectric ovens (when in sheet form) at almost any rate and thickness in widths up to 60 in.

A small commercial-size foamer (*see cut*) produces 100-300 lb./hr. of foam, depending on the density desired. Larger units make up to 700 lb./hr. A conveyor only 60 ft. long uses a 30-kw. oven to cure continuous sheeting 3 in. thick and 54 in. wide at a rate of 1 ft./min.

▶ **Uses Votator Unit**—In order to make its process work, Elastomer needed equipment for the continuous, closed-system aeration, mixing and cooling of a viscous material. The Girdler Votator, a familiar device for transferring heat to or from viscous liquids, has filled that need, has produced a low-density vinyl foam with a fine, homogeneous cell structure.

Votator equipment enables the vinyl foam producer to thoroughly mix the plastisol and an inert gas—even though plastisols must often be processed at high viscosities and relatively high pressures. At the same time the Votator unit's high rate of heat transfer almost instantaneously obtains the desired discharge temperature, chilling the plastisol for high gas absorption and dissipating frictional heat which would otherwise gel the plastisol before discharge.

▶ **Dielectric Heat Fuses Resin** — The vinyl foam, discharged from the Votator at 20-30 F., must be heated to 300-375 F. to accomplish fusion. Since the foam itself is a poor thermal conductor, its fusion in thick masses presents a formidable heat-transfer problem.

However, because of its dielectric properties, the foam heats uniformly and rapidly while passing through a high-frequency field. Thus, for the continuous fusion of thick vinyl foam slab stock, high-frequency heating is almost mandatory. Most producers use Girdler Thermex apparatus.

▶ **Goal: Low Density** — Biggest hurdle for the Elastomer process was, and still is, getting a low-density foam of high quality. Low density, all other things being equal, means lower cost. It is an especially strong selling point in lightweight cushioning and padding (e.g., airplane seats).

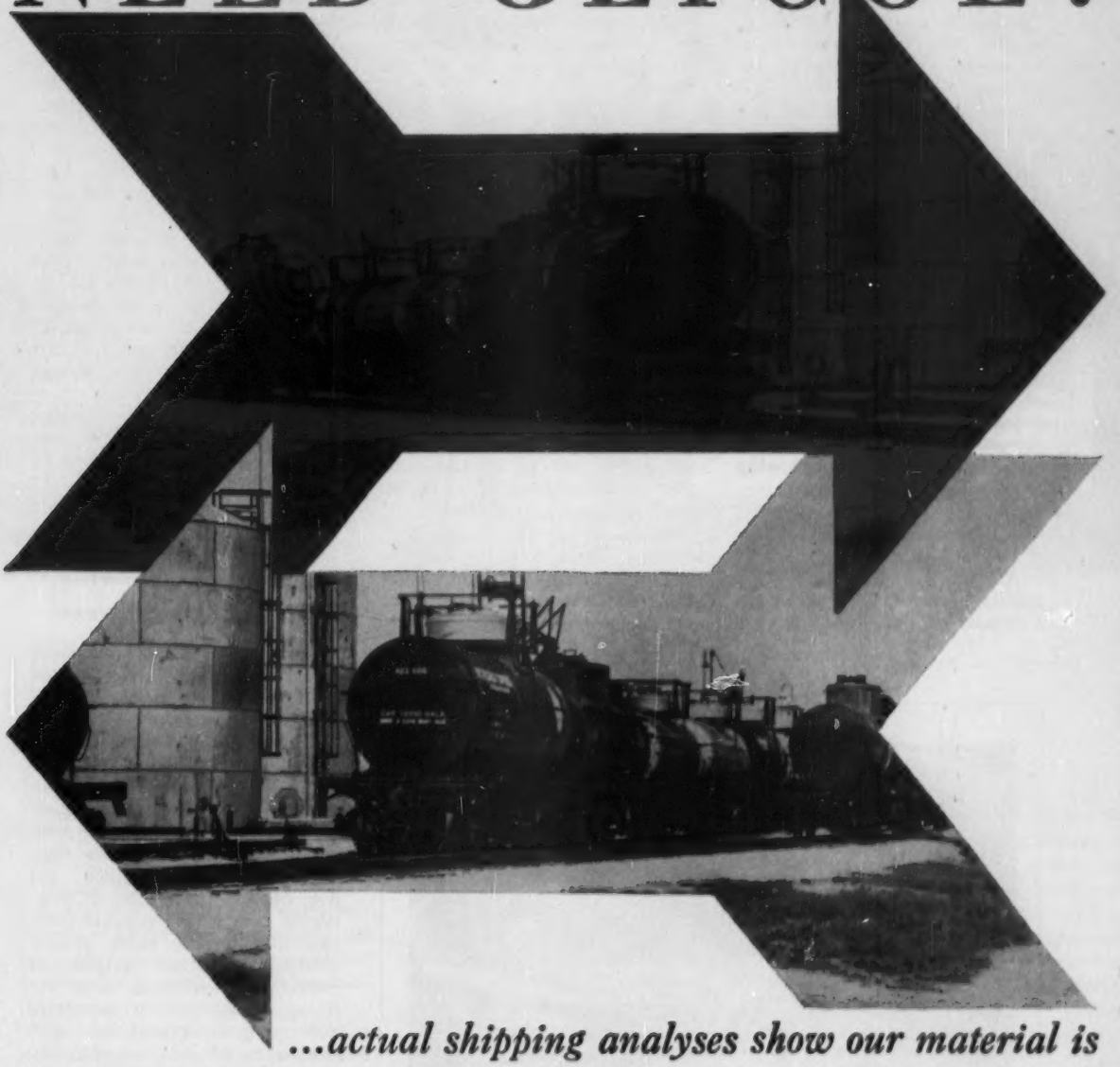
Herein lies polyurethane's greatest competitive appeal: Cushioning with densities of 2-3 lb./cu. ft. Vinyl foam's density has been moving down, though, to meet the competition—10-12 lb./cu. ft. in 1952, then 8-10. Now top-quality foam at 5-6 lb./cu. ft. is a commercial reality. Furthermore, Elastomer is turning out good foam of less than 4 lb./cu. ft. right now in its pilot plant, hopes its licensees will be able to follow suit soon.

▶ **Other Problems** — As density came down, unlooked-for trouble popped up when moisture, which condenses in the foam as it's sprayed, tended to rupture the lighter cell structure during fusion-heating. Foam producers have licked this trouble by dehumidifying their spray discharge areas.

Another point of difficulty: Controlling the tricky fusion process in which the dispersed resin is dissolved in the plastisol to "fix" the foam's cell structure. Underfused foam has little strength, can't be heat-sealed. Overfusion is bad, too, and gives a nonuniform product that causes trouble for the foam user.

Elastomer's increasing experience in high-frequency heating has gone a long way in providing the answer here. (*Continued*)

NEED GLYCOL?



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▶ **Neat But Costly** — Although Elastomer's mechanical foaming process—and its product—have made great gains, they still draw criticism.

Some say the process is complicated and will become more so if the foam is further improved. They point to the large capital investment in development and equipment to set up the process. Just to get into small-scale production means laying perhaps $100,000 on the barrelhead, a stiff tab for a small licensee.

Then there's the complete dependence on a patent situation—the royalty a licensee must pay on every pound of foam produced during the life of the patent.

Advocates of chemical blowing say they need less costly equipment. Elastomer freely admits this but stoutly maintains that chemical blowing simply cannot continuously produce as high a quality open-cell foam at as low a density as can the mechanical process. To bolster its argument, Elastomer claims at least 85% of the present open-cell resilient vinyl foam output for its licensees.

What about these licensees? It's a cinch that all of them, whether they are in production or not, have this in common: Enough regard for Elastomer's process and product to want the manufacturing savvy and rights in case vinyl foam scores a major market breakthrough.

Alcoa Boosts Alumina And Smelter Capacity

Aluminum Co. of America has set early 1958 as startup date for a 150,000-ton/yr. smelter near Evansville, Ind., and for a 500,000-ton/yr. alumina plant at Point Comfort, Tex.

The primary aluminum reduction plant, to cost $80 million, will be located on the Ohio River. It will include a 347,000-kw. steam power plant, fired by coal. Alcoa has signed a long-term contract with Peabody Coal Co. for mining and supplying the coal to the power plant, which will be operated by Southern Indiana Gas & Electric Co.

For the production of alumina, the company will spend $45 million on the Point Comfort plant, which will supply existing smelters there and at Rockdale, Tex.

In Canada, Aluminum Co. of Canada has just boosted flow of aluminum from its Kitimat smelter to 120,000 tons/yr., an increase of 30,000 tons. To do this, Alcan opened its third potline, marking completion of the first stage in its expansion march to ultimate production of 550,000 tons/yr.

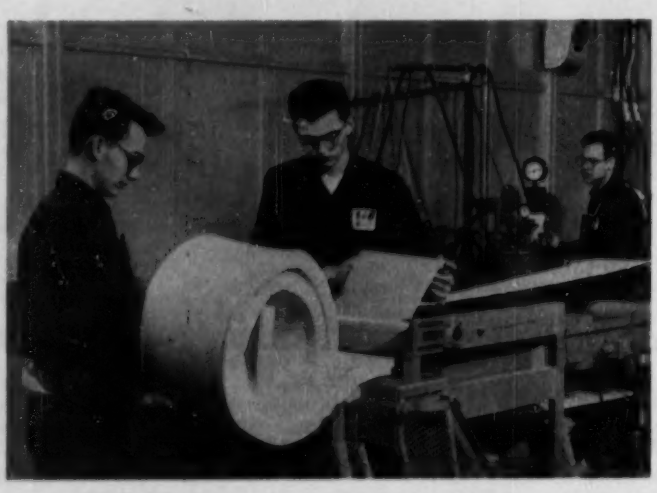
Esso Answers Motorists' Call for Higher Octanes

Breaking with the traditional two-grade system, Esso is now retailing a third grade of gasoline of higher octane. It is 3¢/gal. higher in price than its premium grade.

Adding a grade, rather than upping octane rating of the existing premium grade, fills the need of late-model automobiles with high-compression engines, yet does not tap the wallets of owners of cars whose engines can't capitalize on the extra octane. Further, limiting output of higher octanes keeps down refinery investment in expensive reforming equipment and permits more efficient use of crude.

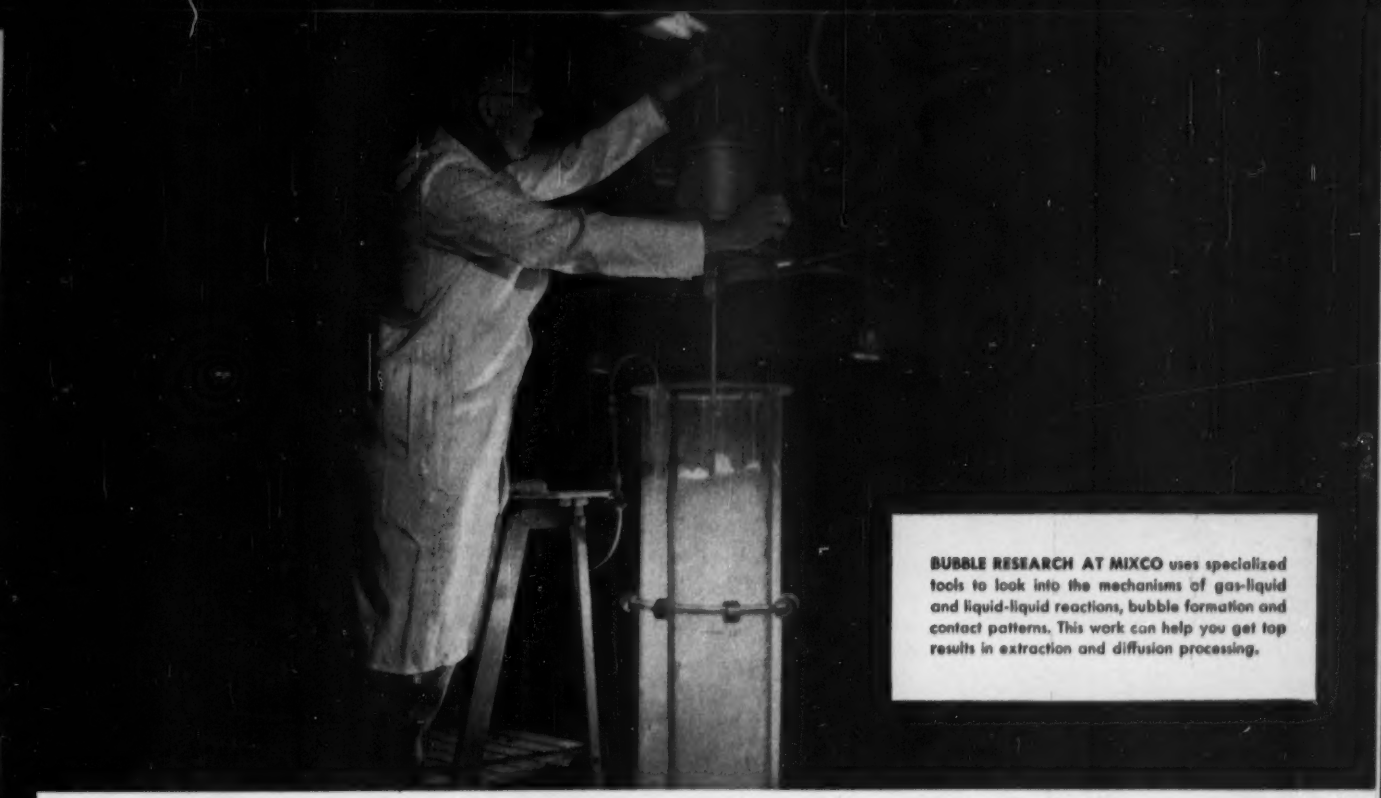
Sun Oil, at Orlando, Fla., service stations, has advanced a different solution to the same problem: Blending, at the pump, five progressively higher grades with a top antiknock quality in excess of 100 octane.

However, Esso believes that its system has advantages: Blending pumps cost 2½ times as much as standard pumps; Sun is adding only octane for their upgraded gasoline, while Esso can upgrade the over-all quality; there's extra processing cost involved in first making a high-octane concentrate, then injecting it back into low-grade gasoline.



Du Pont Pilots New Rubbers to New Markets

Experimental unit for continuous manufacture of urethane foam, above, is one of many pilot-scale installations at Du Pont's $2.8-million elastomers laboratory just opened at Chestnut Run, Del. Among other facilities: Equipment for manufacture, curing and testing of tire treads. In addition to urethane foams and rubbers (made from Du Pont's Hylene organic isocyanates), new product development and technical service work at the laboratory focuses on Hypalon (chlorosulfonated polyethylene) and the company's older offspring, neoprene.



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- ☐ B-107 Data sheet for figuring mixer requirements

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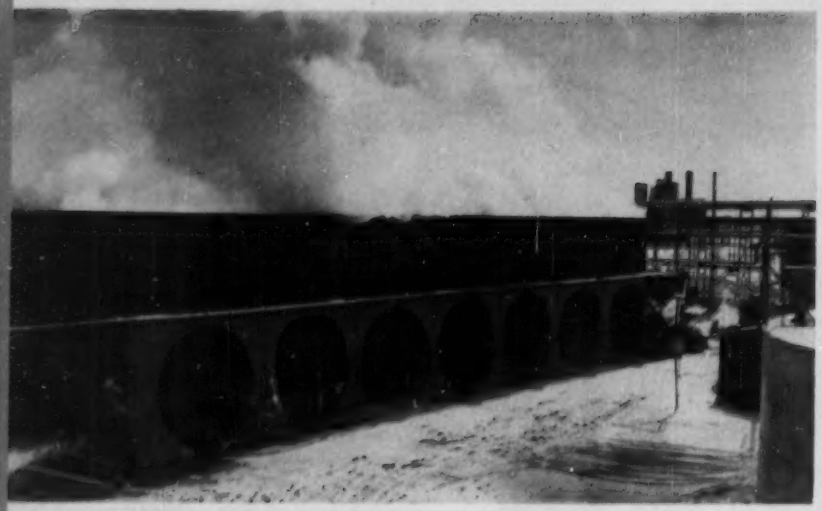


Dual-purpose Towers . . .

Purify While They Cool

Sun Oil gets double duty from its cooling towers by using them as biological filters to control water pollution at its Toledo refinery.

Any processor who wants to save water and ease his pollution headaches at the same time will do well to take a look at what's been going on this past year at Sun Oil's Toledo refinery.*

This refinery uses waste process water to reduce net cooling water makeup requirements by 40%, relieves the pollution load for neighboring streams, saves on chemical treatment of cooling water and waste process water, has even set up a virtually unlimited water supply for emergency fire protection. And all this is done with surprisingly little extra equipment.

Behind this smooth interplay of benefits is the sound engineering thinking which reasoned that a cooling tower system would, if fed the right kind of water, provide an almost ideal kind of environment for bacterial growth.

A cooling tower could, Sun thought, function as a trickling filter, could effect the biological oxidation of liquid organic wastes.

▶ **Reduction to Practice**—Acting on their theory, Sun's engineers took over a redwood cooling tower as a proving ground, used 500-950 gpm. of waste process water to its 18,000-gpm. cooling water load, and began to check performance.

The test tower didn't let them down. Bacteria, thriving in the water as it traveled through the cooling system, oxidized and destroyed phenols, sulfides, mercaptans, and reduced chemical oxygen demand introduced via the waste process water. Final net tower blowdown (effluent bled from the system to preclude excessive solids buildup) could, it was found, be discharged directly to a receiving stream after gravity separation of residual oil and solids.

Encouraged, Sun Oil plans to recycle all its reusable waste water — low-alkalinity process streams and storm water — to several existing refinery cooling towers, with no pretreatment beyond gravity separation and impounding for four to six days. It all adds up to a reuse rate of 1,500 gpm. out of total refinery makeup water requirements of 3,400 gpm.

Cooling Towers Remove These Pollutants

Pollutant	Average Tower Makeup, Lb./Day	Average Tower Blowdown, Lb./Day	% Removed
Phenols	175	0.22	99.9
Oxygen demand	2,516	905	64.0
Sulfides	13	0	100
Mercaptans	8.5	0.8	90.5

▶ **Reuse No Cinch**—Many plants would like to make better use of their water resources. Water conservation is becoming more imperative. So is pollution control. Water reuse—with its lower net discharge—helps meet both needs.

But to recycle process water safely, you'll normally have to treat it before putting it to work again. The cost of treatment may negate all other benefits.

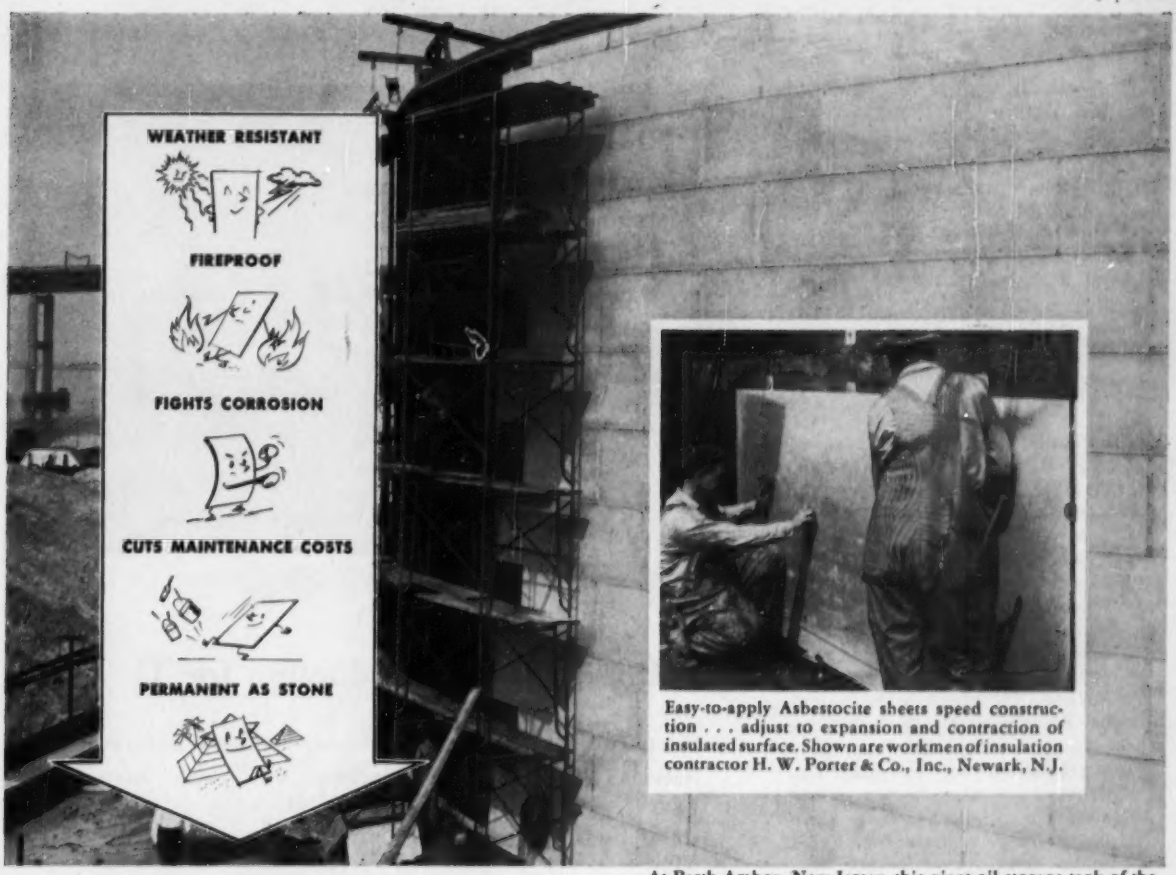
This need for costly intermediate treatment has discouraged wider reuse of liquid wastes in processing. Sun's neat scheme of letting cooling towers double for trickling filters makes reuse more feasible.

▶ **It Figures**—Sun's original reasoning went like this:

Our cooling towers possess three essential features of bio-oxidation equipment: 90-100 F. water temperatures; extensive internal contact surfaces; and plenty of oxygen. And, if we add waste process water to the system, we'll have the nutrients needed for bacterial growth—nitrogen, from the ammonia in cat cracking waters, and phosphorus, from the polyphosphate normally added to the cooling system's water for sequestering and corrosion inhibition.

There are other arguments, aside from bio-oxidation potential, for choosing cooling tower systems for process water reuse. Cooling towers have a high volume demand, need relatively low-quality water compared to direct processing uses, and can

* News of this development was previously reported in *Chemical Engineering*, Dec. 1955, p. 110. This month's follow-up story is based on a paper delivered by Sun Oil's Harold Elkin at the American Petroleum Institute's Montreal meeting this spring.



Easy-to-apply Asbestocite sheets speed construction . . . adjust to expansion and contraction of insulated surface. Shown are workmen of insulation contractor H. W. Porter & Co., Inc., Newark, N.J.

At Perth Amboy, New Jersey, this giant oil storage tank of the Reserve Terminal Corporation is protected with J-M Asbestocite.

5 reasons why J-M Asbestocite® asbestos-cement sheets

give insulated equipment more protection per dollar

NO OUTDOOR INSULATION JOB is really complete unless it is provided with permanent protection against weather. That's why so many engineers specify Johns-Manville Asbestocite® for protecting insulated tanks, vessels, towers, stacks and other outdoor equipment.

Asbestocite combines these five important advantages in one material:

Weather resistant—Asbestocite is unaffected by exposure to sun, wind, rain, snow or temperature extremes.

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Permanent as stone—Stonelike Asbestocite is practically indestructible. It has virtually unlimited service life.

J-M Asbestocite is made of asbestos and cement combined under tremendous pressure into a uniform, monolithic sheet. Its stone-grey color provides a handsome appearance. Write for free brochures IN-121A and IN-173A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

For small diameter equipment, J-M Asbestocite is available *precurved* for easier application and snugger fit as shown above on vessel at Standard Oil Company of California's Richmond refinery.

Johns-Manville *first in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

effectively reduce, by evaporation during recirculation, the net liquid volume which must be treated further before discharge.

▶ **Mission Accomplished** — A year of operation has justified Sun Oil's experiment. Biological oxidation of waste waters during reuse has:

- Consistently reduced phenol content by more than 99%.
- Shaved chemical oxygen demand more than 60%.
- Virtually eliminated residual sulfides and mercaptans.
- Repressed growth of biological slime in the cooling tower systems, eliminating the need for chlorine.*

▶ **Supporting Steps** — First phase of the Sun Oil program was installation of a flue-gas stripping tower for removal of most of the sulfides from process waters slated for reuse. Sulfides interfere with biological activity and cause corrosion.

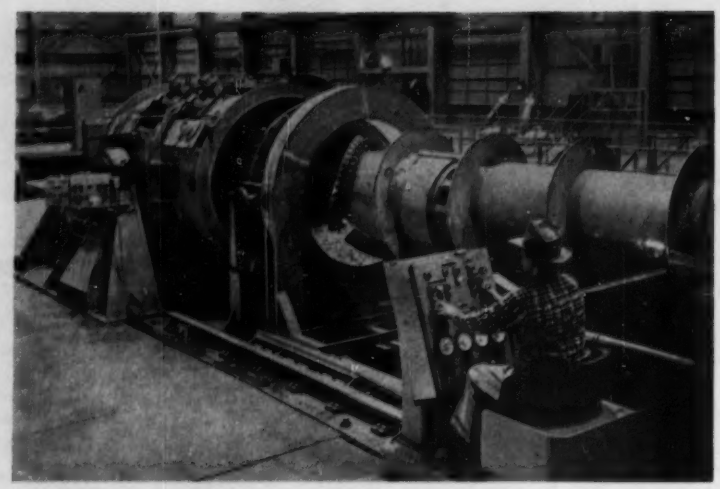
Second step saw complete segregation of low-alkalinity process waste waters—from such operations as steam stripping, once-through cooling of pump bearings—together with contaminated storm water from ground runoff. After retention in the separators and impounding basin—for primary removal of oil and settleable solids—these waters were suitable for reuse (and bio-oxidation) in the cooling-water systems.

Biological growth of phenol-consuming organisms in the system is automatic and self-perpetuating. No seeding is necessary. Only the presence and character of the waste process water is necessary to encourage air-borne and water-borne bacteria to settle down and grow.

▶ **No Penalties** — There have been no adverse effects on the heat-transfer efficiencies of tubular cooling units served by the reused water. Nor have corrosion rates risen.

Examination of the 18-year-old redwood test tower, after four months' service, showed no sign of deterioration from biological effects.

* This could mean a tidy saving to a refinery considering reuse of waste process water, since the hydrocarbons in waste water under treatment could chew up substantial amounts of chlorine.



"SPALT" leaves reactor via reamer-nosed screw conveyor

New Plant Uses Na Reduction for Ti

Electromet gets $TiCl_4$ from Columbia-Southern, sodium from National Distillers; reciprocates with raw materials.

At a new 7,500-ton/yr. plant in Ashtabula, Ohio, titanium production via sodium reduction, rather than conventional magnesium reduction, makes its U.S debut. The plant marks the entry of Union Carbide's Electro Metallurgical Co. into the titanium field. Further, it gives the company the biggest single share of the 24,900-ton/yr. total sponge capacity which the nation is slated to achieve by year's end.

▶ **Supplies Via Triple Play**—Electromet's plant is the central figure in a sort of triple-play-plus with suppliers of its sodium and titanium tetrachloride. Liquid titanium tetrachloride comes from Columbia-Southern's new 35,000-ton/yr. Natrium, W. Va., plant, which in turn gets raw titanium-bearing ore from Electromet. (Catalytic Construction Co., Philadelphia, designed and built both new plants.)

National Distillers' Ashtabula, Ohio, operation supplies Electromet with liquid sodium, gets back sodium chloride solution recovered from the reduction process. Higher purity of reducing agent (hence, higher purity of titanium), plus greater ease of handling liquid sodium rather than solid magnesium, are among the advantages claimed for sodium reduction.

▶ **Reaction in a Well**—Electromet feeds sodium and titanium tetrachloride, each in liquid form, to a reactor set below floor level in an insulated well. Exothermic reaction produces a mass of "spalt," a mixture of titanium sponge and sodium chloride salt.

Lifted by crane from the well, reactor stays put in container, shown on its side above, while the solid spalt is broken up and removed. Crushed spalt goes to a washing tank to dissolve the salts, then titanium and salt solution are separated by centrifuge.

In Britain last spring, ICI started up the world's first plant to use sodium reduction for titanium, a 1,500-ton/yr. unit.

Firestone to Make Both Major GR-S Components

Hard on its announcement of a 40,000-ton/yr. butadiene plant to be built at Orange, Tex., Fire-

Particle Classification

BOTHERING YOU ?

Are you looking for improved methods of wet classification of your solids—continuously? Sharples has specialized in solids classification for many years; particles as small as ½ micron up to those ½" in size can be efficiently classified in slurries with as little as 1 to 2% solids content as well as thick sludges.

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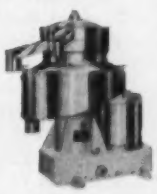

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stone has come forth with plans for an adjacent 75,000-ton/yr. styrene plant. First in the rubber industry to produce the principal raw materials for manufacture of its synthetic rubber, the company will complete the butadiene unit early in 1957, the styrene unit early in 1958.

First U. K. Plant Set For Low-Pressure Poly

Britain will produce its first low-pressure polyethylene in about a year when Shell Chemical Co. Ltd. completes a 1,000-ton/yr. plant now under construction. Ziegler process, to which Shell has exclusive rights in Britain, will be used.

The company is also hard at work in the laboratory seeking new ways to exploit the Ziegler process. Researchers, led by Britain's noted chemist, Sir Robert Robinson, are concentrating on the use of starting materials other than ethylene.

Britain's only other manufacturer of polyethylene—the high-pressure variety—is Imperial Chemical Industries. That company has recently introduced a new polymer called Alkathene H.D., which is believed to have properties similar to the Ziegler material. And several firms have shown that it is possible to obtain certain properties of Ziegler polyethylene by exposing ordinary polyethylene to intense sources of radioactivity.

Ziegler's exclusive licensee in the Benelux countries, Staatsmijnen of Limburg, is also building a plant to be completed late in 1957 in Beek, Holland.

In Britain, Shell has also announced its intention to spend $56 million in the next three years on plants to make chemicals from petroleum.

This investment is part of a national trend towards the use of oil, rather than coal, as a source of important chemicals. Apparently the trend is progressing so fast that it may be possible for the petroleum industry to make use of what promises to be a large surplus of lighter hydrocarbons when Britain's oil refineries expand to meet national demand for fuel oil.

Following the recent announcement that Esso Petroleum Co. is to produce raw materials for the first full-scale rubber-from-oil plant in Britain, the company now states that this project involves construction of a $25-million petrochemical plant at its Fawley refinery in Hampshire, England. Due for completion in 1958, it will process nearly 250,000 tons/yr. of crude petroleum into such materials as ethylene, propylene, butylene and butadiene.

It is rumored that one of the chief markets for Esso's ethylene may be a new high-pressure polyethylene plant to be built by Monsanto near Fawley.

Last summer Union Carbide announced its intention to build a high-pressure polyethylene plant at Grangemouth, which will be in operation by the fall of 1958. To obtain ethylene from the British Petroleum refinery at Grangemouth, it is reported to have an initial capacity of 11,500 tons/yr. and to cost about $12 million.

Super-Size Al Cells Gain New Convert

By adding only 18 new cells to its Tacoma, Wash., reduction plant, Kaiser Aluminum & Chemical Co. boosted primary aluminum capacity of this plant from 10 million lb./yr. to 77 million.

Designed to operate at 110,000 amp., the new cells are twice the size of the conventional cells in the plant and rank among the biggest ever used. Lower power consumption—about 7.5 kwh./lb. versus 8.5 kwh./lb., the reported industry average for conventional cells—is the main selling point of the big cells.

This and other advantages have led to their widespread use in the past few years (*Chem. Eng.*, May 1955, p. 117). For example: Reynolds Metal Co. has 400 of the giant cells distributed between its two newest reduction plants—at Corpus Christi, Tex., and at Arkadelphia, Ark.—each cell producing 2,000 lb. of aluminum daily; Alcan has 346 100,000-amp. cells in its new Kitimat, B. C., plant. Kaiser has been something of a hold-out in the swing to using the big units.

Another expansion planned by Kaiser: 55 million lb./yr. added to primary aluminum capacity at its Chalmette, La., reduction plant. Bringing production to 247,500 tons/yr., a potline will start by summer of 1957.

Convention Calendar

Atomic Industrial Forum and Denver Research Institute, atomic energy conference, "Uranium and the Atomic Industry," Cosmopolitan Hotel, Denver, June 25-26.

American Society for Engineering Education, Chemical Engineering Division, annual meeting, Iowa State College, Ames, Iowa, June 25-26.

Stanford Research Institute, symposium on "High Temperature—A Tool for the Future," University of California, Berkeley, June 25-27.

American Society of Electrical Engineers, chemical sessions of the Pacific and Summer General Meeting, Hotel Fairmont, San Francisco, June 28.

Society of the Chemical Industry, 75th annual meeting, Belgrave Sq., London, July 9-14.

Western Packaging & Materials Handling Exposition, Pan Pacific Auditorium, Los Angeles, July 10-12.

British Plastics Exhibition & Convention, British Plastics Federation, Grand Hall, Olympia, London, July 10-20.

American Oil Chemists' Society, 1956 short course on unit processes in fatty oil, soap and detergent industries, Purdue University, Lafayette, Ind., July 16-20.

American Soybean Assn. and National Soybean Processors Assn., joint annual meetings, University of Illinois, Urbana, Aug. 12-15.

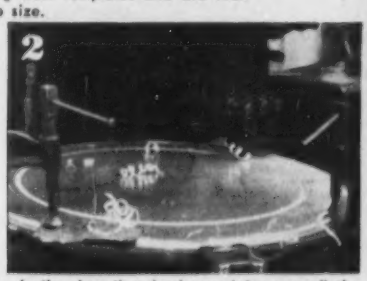
Combustion Institute, Sixth International Symposium on Combustion, Yale University, New Haven, Aug. 19-24.

Steps to a CB&I built Aluminum Tank

• These photographs show some of the operations necessary to fabricate and erect six aluminum tanks, 17 ft. in diam. by 17 ft. 9 in. high. They were built by Chicago Bridge and Iron Company for the Carbide and Carbon Chemical Corporation at Institute, West Virginia.

CB&I is a leader in the field of specialized welded plate structures with more than 65 years of experience. Their four plants have complete facilities for designing, fabricating and erecting steel and other metal plate structures to the most exacting requirements. When you plan . . . plan with CB&I. Write our nearest office for further information.

Aluminum plates in the plant receiving yard. From here, they go to the layout shop for marking from templates and are then trimmed to size.



In the shop the aluminum plates are rolled to the required shape and fittings and connections are machined to the proper dimensions.

This view inside the tank shows the lower ring of the shell being welded to the aluminum bottom.

Above: The top ring, roof and fittings, after being welded together are lifted into place as a unit.

Below: Field erection is complete and the tanks have been inspected and tested.

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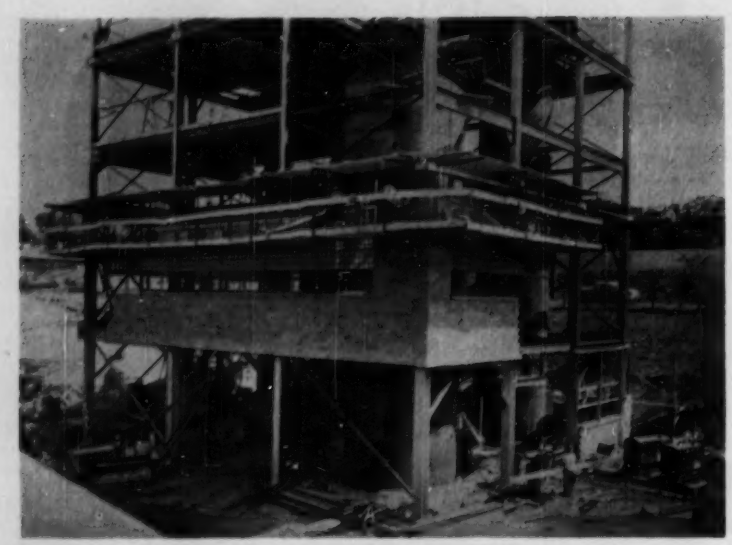


Bleaching unit at an International Paper mill illustrates trend as . . .

Pulpers Switch to Dioxide

Development of practical processes for generation of chlorine dioxide at point of use has triggered a rush to cash in on its desirable bleaching properties.

Today's trend to chlorine dioxide bleaching of wood pulp has begun to assume bandwagon proportions.

At least 36 U. S. pulp mills are now bleaching with ClO_2 or are installing the necessary facilities. Another 20 to 30 more installations are under consideration.

Speed with which this trend has developed, especially in view of the traditional conservatism of the pulp and paper industry, is noteworthy even in today's technologically sophisticated economy. First use of chlorine dioxide for pulp bleaching began on kraft pulps in 1946 in Canada and Sweden, and in 1952 in the U. S. And though still used predominantly on kraft pulps, it is now being applied to sulfite and dissolving pulps.

▶**Why the Switch?**—Compared with other bleaching agents, chlorine dioxide has many advantages which pulp bleachers can't afford to overlook. ClO_2 boosters claim that it:

- Oxidizes lignin to water-soluble, colorless compounds without appreciably affecting the cellulose.
- Bleaches paper pulp without loss of strength.
- Produces a whiter pulp, in combination with other bleaching stages, than can be made with any other commercial bleaching agent.
- Produces desired levels of brightness with fewer stages.
- Yields these benefits at little or no additional cost. Most mills can generate ClO_2 for about 20¢/lb., including capital charges, raw materials costs, operating costs and overhead. Since 1 lb. ClO_2 is chemically equivalent in oxidizing power to 2.63 lb. available chlorine, this means that chlorine dioxide costs about 8¢/lb. as available chlorine. This is about the same cost as for sodium hypochlorite in many mills.
- Can be used over a wide range of operating conditions—pH (2.5-9.0), temperature (up to 170 F.), time, consistency and brightness (anywhere from 84 to 91 GE).

▶**Why the Delay?**—Ability of chlorine dioxide to bleach and remove impurities from cellulosic materials has been known for many years.

Until recently, however, its use by the pulp industry was impractical. It is toxic, explosive and corrosive. Shipment as a compressed or liquefied gas is dangerous; shipment in solution is expensive.

Generation of ClO_2 at its point of use has provided the answer. Of the many different processes proposed, the ones which triggered the present boom in the pulp industry are all based on the reduction of sodium chlorate in an acid medium to produce gaseous ClO_2.

Counting Brown Co.'s recently announced technique, there are now seven chlorate-based chlorine dioxide generating processes available. Four of them are European in origin, three are American. Domestic interest has, so far, been divided about equally between two U. S. processes—those developed by Olin Mathieson and by Solvay Process Div. of Allied Chemical & Dye Corp.

▶**Solvay Uses Methanol**—Solvay's process is based on reduction of $NaClO_3$ with methanol in sulfuric acid. The reaction is carried out in packed towers in three stages.

Chlorate and acid feed continuously into the first tower, with the liquor in constant circulation over the packing. Liquor level in the first tower is maintained by continuous overflow to the second tower which, in turn, overflows to the third tower. Methanol is metered into each tower's circulation line.

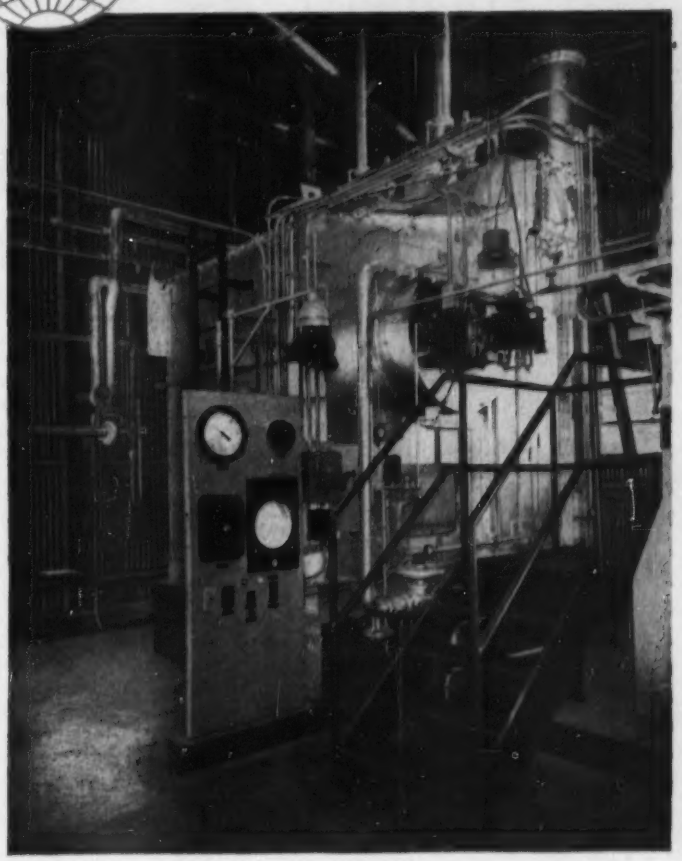
An air stream passing in series through the towers continuously strips the ClO_2 as it is made. The gas is then absorbed in water. Conversion of chlorate to ClO_2 is 85 to 90%.

▶**SO_2 for Mathieson**—In Mathieson's process, streams of concentrated chlorate solution and

THREE MILLION BTU / HR

for New ATLAS Chemical Plant

FW Dowtherm Vaporizer plays vital role in emulsifier plant of Atlas Powder Company's Chemicals Division



The 3,000,000 btu/hr Dowtherm vaporizer shown above, designed and built by Foster Wheeler, is installed in Atlas Powder Company's new emulsifier plant at Memphis, Tenn. Here, degree-splitting temperature control is a vital factor in maintaining the high quality of Atmul® food emulsifiers used to improve the keeping quality, palatability and appearance of many foods.

Wherever high-temperature, low pressure process heating is required, Dowtherm vaporizers by Foster Wheeler can save time, effort and expense. That's because only FW does the complete job—designs equipment to your exact requirements, manufactures and installs it, puts it into successful operation and provides all necessary servicing. For further details, send for Bulletin ID-54-5. *Foster Wheeler Corporation, 165 Broadway, New York 6, New York.*

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concentrated sulfuric acid feed into the top of a lead-lined tank. Sulfur dioxide, diluted with inert gas, enters through diffuser plates at the bottom.

Chlorine dioxide, generated during rapid agitation of the reaction mixture, is stripped from solution by the inert gas accompanying the SO_2, then absorbed in water. Yield is also 85-90%.

▶**Just Salt in Acid**—The new Brown process, not yet in commercial operation, involves the reaction of strong $NaClO_3$-NaCl liquor produced in an electrolytic cell with gaseous HCl in an air current.

When the HCl is substantially reacted, partially spent chlorate liquor is returned to the electrolytic cell, where chlorate content is raised to its initial value. This cycle is repeated continuously. Yields, based on small-scale operation, are said to be as high as 91-94%.

▶**Suppliers Hold Their Own**—Although chlorine dioxide bleaching is growing steadily, it hasn't appreciably affected suppliers of other bleaching agents—at least, not so far.

Producers of hydrogen peroxide, for example, seem pretty well agreed that chlorine dioxide bleaching will have little effect on their markets, since H_2O_2 is primarily used on groundwood pulps. If anything, the new technique may increase demand for peroxide. For a H_2O_2 bleaching stage often follows chlorine dioxide bleaching to minimize color reversion of the pulp.

Sodium chlorate producers claim a 25% increase in 1955 chlorate consumption over 1954, primarily because of wider usage of ClO_2 in pulp bleaching. And they look to still greater increases in sales if the growth pattern of dioxide bleaching continues at today's rapid pace.

New Processes Stud Paper Plant Addition

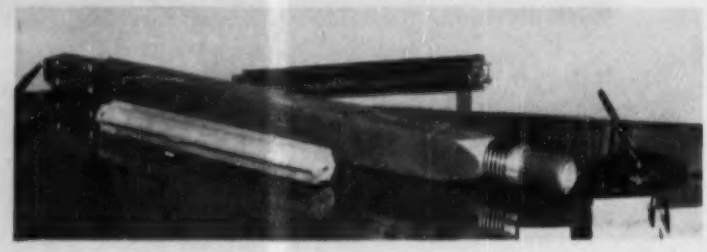
The $17-million worth of plant additions underway at Brown Co.'s Berlin, N. H., pulp and paper mill provide at least two innovations in commercial processing plus a pilot plant to experiment with continuous cooking of any cellulosic raw material.

A new chlorine dioxide plant debuts a company-developed process said to produce higher yields and to work faster than well known Olin Mathieson or Solvay processes (*see above*). According to Brown, its process minimizes wasteful side reaction. It utilizes only sodium chlorate and hydrochloric acid, unlike older processes which involve sulfuric acid and a reducing agent such as methanol or sulfur dioxide.

Also, Brown will build the nation's second plant to use Babcock & Wilcox's magnesium bisulfite pulping and chemical recovery system. Substitution of magnesium oxide for conventional calcium oxide makes it possible to recover both the chemical and heat values in waste sulfite liquor. To be completed in 1957, Brown's installation will process 750,000 lb./day of waste liquor solids. Designed to operate at 875 psi., the boiler will produce 160,000 lb./hr. of steam at 825 F. The country's first MgO installation, that of Weyerhaeuser Timber Co., is in operation at Longview, Wash.

The digester pilot-plant project has been undertaken in conjunction with Black-Clawson Co. The latter will provide a Pandia continuous digester to accommodate study of pulping procedures of short cooking cycles at high temperatures and pressures. Facilities will be available part time to the paper industry.

In addition to the current plant additions, Brown is said to be negotiating three different deals that could expand its productive capacity still further.

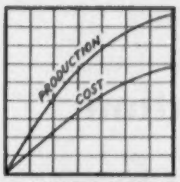


Pegged for Changes: Nuclear Fuel Types, Fabrication

Producing new and better nuclear fuel elements is the first target for Sylvania Electric Products' proposed multimillion-dollar expansion in the atomic power field. New production and development facilities, at an unannounced eastern location, will be completed late in 1957. Already in atomic fuels production (photo above shows three existing types of fuel elements; right, uranium fabrication), Sylvania believes the business will grow to $500 million/yr. by 1975.

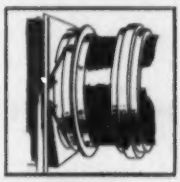
*Trona is the well known trade mark of American Potash and Chemical Corporation, one of the nation's largest producers of diversified chemicals for industry and agriculture.

9 REASONS WHY TRONA* USES STANDARD DRYERS



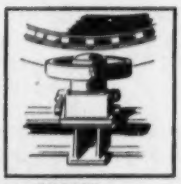
1 HIGHEST PRODUCTION AT LOWEST COST

2 EASY FINGERTIP CONTROL

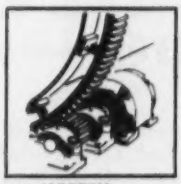


3 METAL TO METAL SEALS

4 COMPLETE CHOICE OF MATERIALS



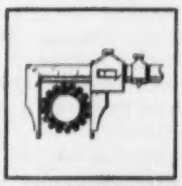
5 RUGGED RUNNING GEAR



6 MODERN SMOOTH DRIVES

7 ANTI-FRICTION BEARINGS

8 DESIGNED TO DO THE JOB



9 UNCOMPROMISED PRECISION

There are many reasons why successful companies . . . located throughout the world . . . buy Standard Dryers again and again! Here are *nine* of the reasons why Standard Dryers are *the best profit producers.* One company, American Potash and Chemical Corporation, recently installed its fifteenth Standard Dryer . . . all operating under the difficult and severe conditions of California's Mojave Desert. This indicates that Standard Dryers are good.

Standard's years of experience make possible the development and manufacture of trouble free, efficient and economical dryer units—ready for handling difficult jobs! And remember! Standard's pilot dryers play an important part in solving your drying problems *before* blueprint stage.

Put your plant on a more profitable basis by *writing today* for our free 12-page illustrated catalog.

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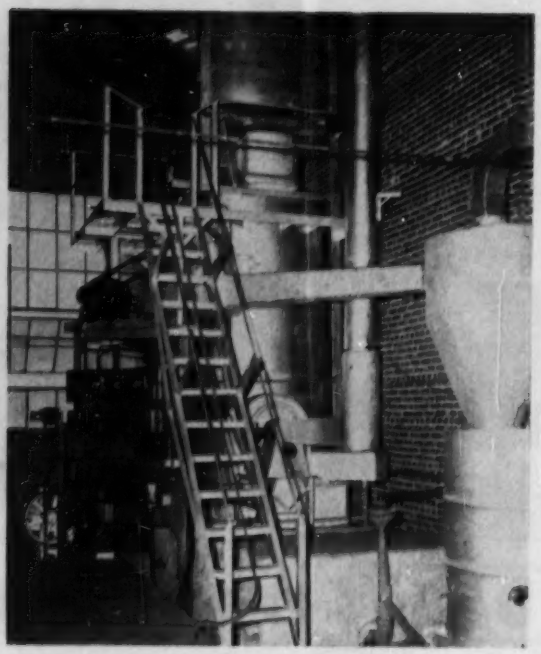
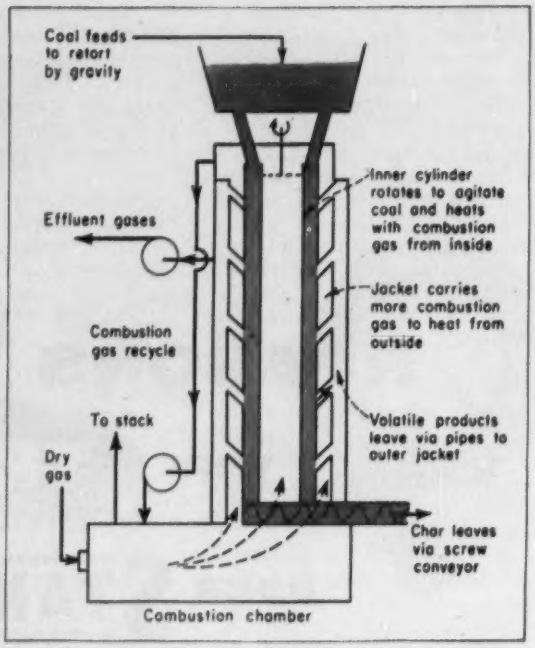
STANDARD HERSEY DRYERS

PILOT TESTING



PILOT PLANT turned out 1,000 lb./hr. of char.


Coal feeds to retort by gravity
Effluent gases
Combustion gas recycle
To stack
Dry gas
Inner cylinder rotates to agitate coal and heats with combustion gas from inside
Jacket carries more combustion gas to heat from outside
Volatile products leave via pipes to outer jacket
Char leaves via screw conveyor
Combustion chamber

ANNULAR reaction space is heated from both sides.

Coming: Medium-Temperature Carbonization

New process emphasizes production of char, rather than chemicals, from low-grade Western coals. Output from new plant will help make nonferrous metals.

With feet confidently planted in Western raw materials and markets, a commercial plant using a new medium-temperature coal carbonization process will start building next month at Red Lodge, Mont.

Raw material will come from the West's abundant, but heretofore relatively useless, supply of subbituminous coal. The region's nonferrous metal refineries promise ready-made and growing markets for the plant's major product, a soft char chemically similar to byproduct coke from high-temperature ovens.

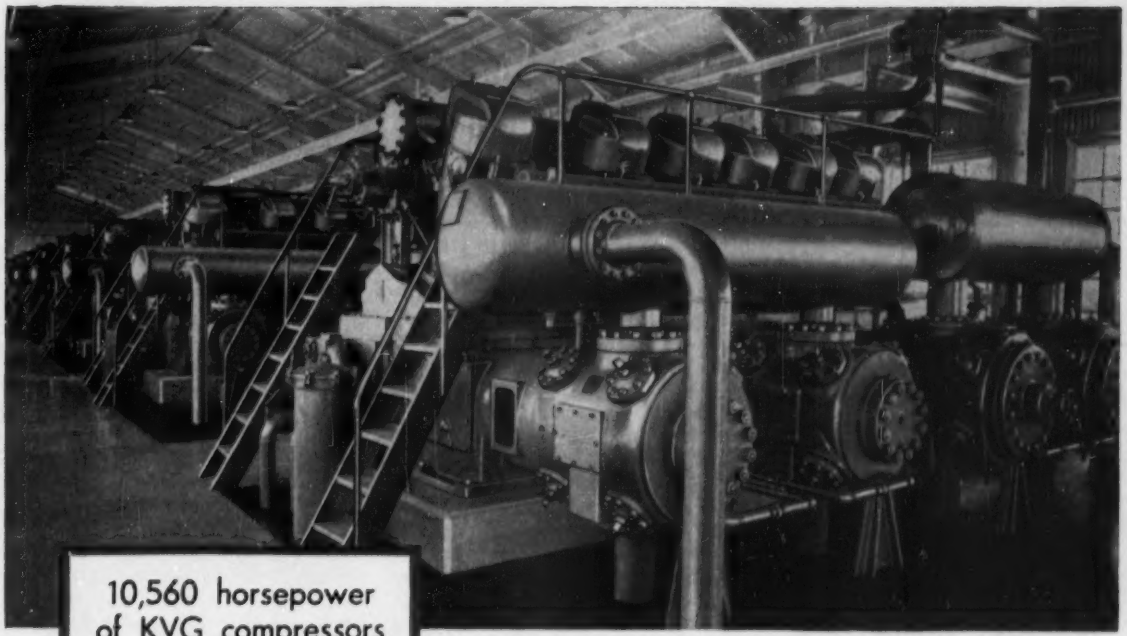
To be built by Koal Krudes, Inc. (financed by a group of Spokane, Wash., investors and state and municipal governments in Montana), the $200,000 plant will use about 320 tons/day of coal to turn out 150 tons of char, plus accompanying creosote and coal tar. There are no other Northwest producers of these products in competitive volume.

▶**A Waiting World**—Western metal refiners, like Anaconda at Anaconda, Mont., and American Smelting & Refining at East Helena, Mont., hope to use the char in sponge iron and lead smelting, respectively. It would replace other carbon sources like coke breeze, which must now be imported from Canada and the Midwest. Tar will be sold to Northwest highway departments. Creosote will go to local wood treaters and to the several transcontinental railroads serving the area.

For sintering lead and zinc sulfides, smelters need a concentrated carbon source, low in volatiles. Coke breeze has been the only substance available to fill the bill. Recently, petroleum coke from Carter Oil Co.'s new fluid coking unit at Billings, Mont., has also been used. But operation of the unit, which can produce 160 tons/day of the coke, is irregular; the unit shuts down when the coker's crude feed can find a market as road-building material. So a wide-open market is still left for the new char.

For sponge iron smelting, a type of bituminous coal found in the West—ground and used raw—is OK. But concentrated char may be better (and a lower-grade coal can be used to make the char) if the char can be had at a competitive price. Koal Krudes counts on snaring this market.

▶**Efficient Process**—In addition to the bright supply-and-demand picture, the Koal Krudes process is continuous, avoids the inherent disadvantages of batch techniques used in con-



10,560 horsepower of KVG compressors at Permian Basin Pipeline Company

These eight Ingersoll-Rand KVG gas-engine compressors provide a total of 10,560 horsepower for a gas compression station of the Permian Basin Pipeline Co., a subsidiary of Northern Natural Gas Company. Each machine consists of a 12-cylinder, V-type, four-cycle gas engine with four compressor cylinders mounted on the same frame and driven from a common shaft.

On any service I-R Gas-Engine Compressors offer two basic advantages

Wide load fluctuations are unavoidable in many compressor applications. That's why the *flexibility* of I-R FOUR CYCLE gas-engine compressors is a big asset. They always deliver smooth, steady power all the way from no load to full load and at any speed from half to full rated rpm.

The second basic advantage is in the *compressor end.* Here the extra dependability and the trouble-free performance of I-R job-engineered cylinders and valves add up to exceptionally low maintenance expense. This has been proven repeatedly in hundreds of installations covering all types of air and gas compression requirements.

Ingersoll-Rand four-cycle gas-engine compressors are available in sizes from 110 to 2000 horsepower. Call in your I-R representative when planning your next installation. His experience can save you time, effort and expense all along the line.

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ventional high-temperature carbonization. Unlike batch processes:

- Product is of uniform quality, not exceeding throughout the maximum of 5% volatiles usually specified by smelters.
- Process is well adapted to control by instrumentation, requires a minimum of labor.
- Condensing equipment can be made smaller and at lower cost because it receives the vapors in a steady, moderate stream rather than in large surges.

▶ **How It Works**—As shown in the above sketch, carbonization takes place within a 2-in.-wide annular space formed by two concentric vertical cylinders. Coal, crushed to 1¼ in., is fed into the annulus from above; char discharges from the bottom. The inner cylinder rotates on its vertical axis at 2 rpm., keeping the coal in slight agitation so that each particle has the uniform time-temperature history which makes for a uniform product.

Temperature during the process varies from 1,100 to 1,400 F.; pressure is slightly negative to aid gas flow; retention generally runs 15-30 min.

Process heat is provided by burning byproduct coal gas in a combustion furnace and passing the hot products of combustion up through the inner cylinder and also through an annular jacket, formed by a third cylinder surrounding the retort.

Volatile material passes into another jacket formed by a fourth cylinder. It is drawn off by a blower for condensation. Noncondensed gas supplies more than enough fuel value for the process. Koal Krudes expects to use about half the gas for fuel and flare the rest or use it for drying the coal feed.

Twin stainless steel screw conveyors of adjustable speed remove the char from the reactor. Char is cooled by passing it through a series of water-jacketed screw conveyors. Conventional absorption processes collect the condensed materials.

The plant at Red Lodge will consist of four to six retorts, 30 in. dia. and 10 to 16 ft. high. Dimension of the coal-containing annular space—2 in.—remains the same whatever the size of the retort tubes.

▶ **Good Lineage**—The commercial plant being built is the fruit of experimental operations conducted by PD&P Processing Co. of Lewiston, Idaho, which was formed for the purpose in 1951. Koal Krudes is a PD&P affiliate recently organized to handle operation of the full-scale unit.

The fourth in a series of pilot plants, a $100,000 model, has been in operation for two years at Montana State College, Bozeman, Mont. Lloyd Berg, head of the school's chemical engineering department, has directed the job of perfecting equipment design.

Montana's state legislature, interested in upgrading state resources, invested $40,000 in Koal Krudes research; the Red Lodge Chamber of Commerce underwrote $40,000 worth of Koal Krudes stock during a recent public offering.

▶ **Neither Hot nor Cool**—Comparing Koal Krudes' medium-temperature process with low-temperature (below 1,000 F.) carbonization processes or with standard high-temperature (1,500 to 2,000 F.) slot-type ovens is like using one yardstick to compare apples and oranges.

Low-temperature processes, though usually continuous like Koal Krudes' process, aspire to quality and quantity production of chemicals, as well as of char. For Koal Krudes and the high-temperature processes, the emphasis is on carbon output; chemicals are decidely in the byproduct class. In contrast to Koal Krudes' soft char, high-temperature processes are, of course, tailored to turn out blast-furnace coke strong enough to resist abrasion and crushing.

Because operating temperatures for slot-type ovens run 500 to 800 F. higher, costs of construction and operation are higher than Koal Krudes' anticipated costs. An attempt to use a slot-type plant for charring a noncoking coal at Koal Krudes' 1,100 to 1,400 F. would probably be impractical and uneconomical. The smallest economic slot-type oven battery would turn out about 820 tons/day. It is doubtful whether any one marketing area in the Northwest could absorb this output.

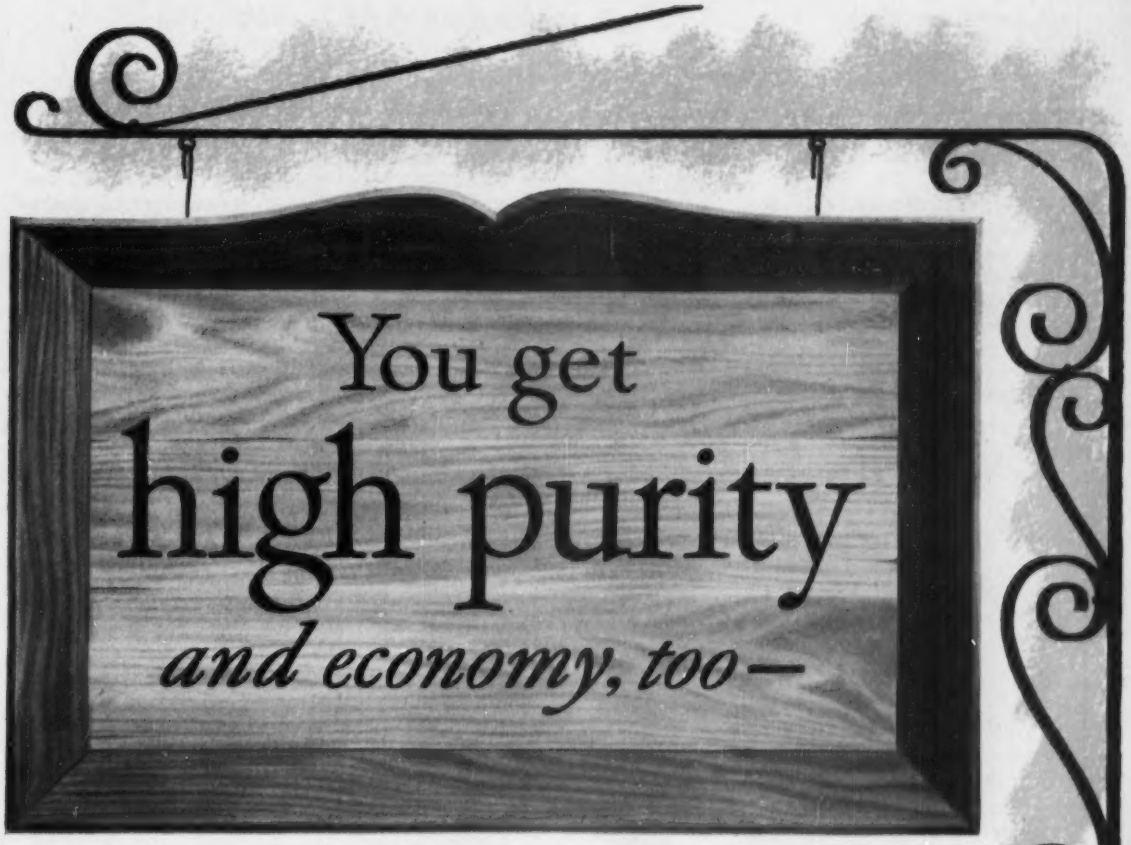
On the other hand, total Northwest demand for smelting carbon far exceeds that available from the area's large existing coking ovens, U. S. Steel's Geneva, Utah, and Colorado Fuel & Iron's Pueblo, Colo., installations. These plants, of course, minimize coke breeze output in favor of maximum metallurgical coke production. In any case, as with carbon imported from Canada and the Midwest, freight charges for Geneva or Pueblo product would add to the smelter's costs.

▶ **Expanding Sponge**—Sponge iron smelting, for one, is a Western char market which is likely to multiply many times in the next few years. And the pattern of this growth promises to form something like "the house that Jack built." Anaconda now uses sponge iron as a precipitant in its leach-precipitation-float process for refining oxides of copper. Because the grade of western copper ores is steadily getting poorer, all refiners must turn increasingly to hydrometallurgical processes, rather than the pyrometallurgy suitable for handling prime ore.

Up to now, many refiners have used tin cans—hard to come by, transport and clean—as their precipitating agent. But they're expected to follow after the Anaconda company in the switch to sponge iron.

To produce 1 lb. of copper, about 4 lb. of sponge iron is needed. And at least 1 lb. of char goes to make each pound of iron produced. Thus, because about 200,000 tons of copper was produced via leaching last year in the West, the potential annual market for char for this market alone now stands at more than 800,000 tons. And this figure may look small stacked against increasingly prevalent oxides of the char's future in refining the copper.

The market may grow still bigger if the char takes a hoped-for place in standard sintering of sulfide ores of lead and zinc.



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- Methyl Isobutyl Carbinol
- Diacetone Alcohol
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- Isopropyl Ether

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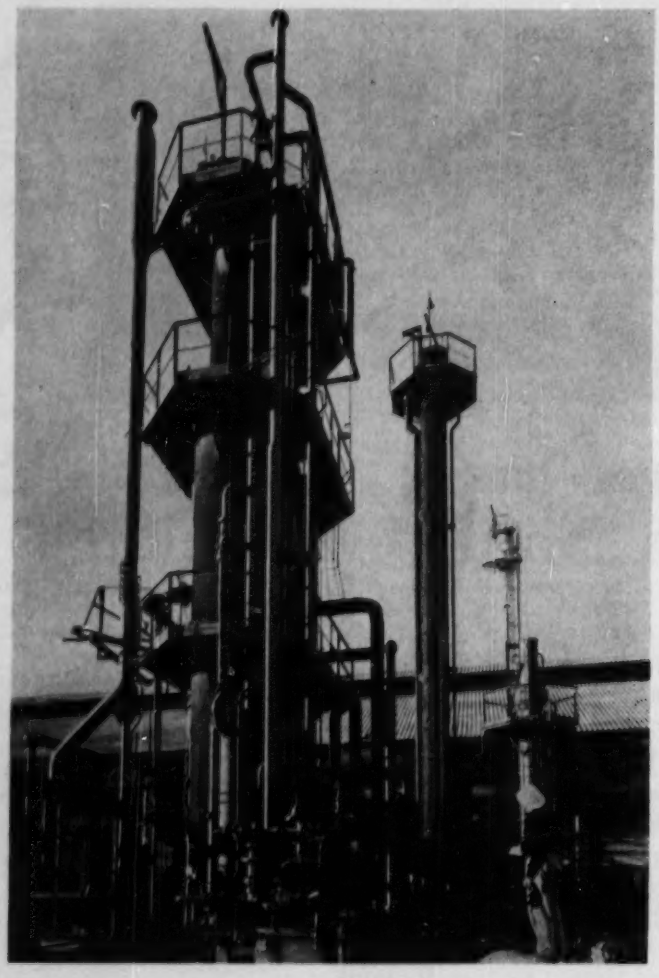
Arkansas to Make More Newsprint, Food Board

International Paper Co. is ready to start building a $57-million newsprint and bleached kraft board mill at Pine Bluff, Ark. And in Ashley County, Ark., Crossett Co. has just completed a $16-million, 150-ton/day bleach food board mill which utilizes up to 65% hardwood pulp.

Annual production at the Pine Bluff mill will be 130,000 tons newsprint and 165,000 tons board. Mill will be completed in the fall of 1957. This September, International will start up its first Southern newsprint mill, a 115,000-ton/yr. unit in Mobile, Ala.

Formerly, International has centered its newsprint operations in Canada. Last February, however, its management reached an agreement with Olin Mathieson to buy 395,000 acres of timberland in Arkansas, Louisiana and Eastern Texas for $33 million. Despite current severe shortages everywhere, the company has selected the industrially expanding South as a region likely to sustain present fast growth of its newsprint market.

Crossett, describing its new plant as the first of its kind in the world, believes that it opens up an important new outlet for hardwoods unusable as saw timber. Semichemical process used, the company feels, will greatly expand the papermaking potential of Arkansas and the whole South. The process employs a double-strength bleach which requires highly automated control, resulting in a beneficiating of the hardwood fibres.



LPG Feeds New Israeli Ammonia Plant

Unusual LPG feed supplies new 14,000-ton/yr. anhydrous ammonia plant of Fertilizers & Chemicals Ltd., Haifa, Israel. Region lacks such common raw materials as methane or natural gas, so the plant pipes refinery gas (about 60% butane, 40% propane) from nearby Iraq Petroleum Co. unit. Liquefying gas at refinery can cut size of required connecting pipeline and facilitate surge storage. Photo shows unit for removing CO after reforming LPG with steam.

News Briefs

Refrigerants: Du Pont is about to start up a multimillion-dollar plant for manufacture of Freon refrigerants and aerosol propellants in Antioch, Calif.

Chlorine: Pennsalt will increase chlorine production from 50 to 150 tons/day at its Calvert City, Ky., works. The McIntosh, Ala., plant of Olin Mathieson will double its production of chlorine and caustic soda in an expansion program to cost $7.5 million. Chlorine output will be 250 tons/day; caustic, 280 tons.

Formaldehyde: Facilities for a 25% increase in production of formaldehyde, methanol, acetaldehyde at Celanese's Bishop, Tex., plant will be completed early in 1957. The company will, for the first time, use its direct oxidation process for production of formaldehyde. Borden Co. will complete a 36-million-lb./yr. formaldehyde plant in Fayetteville, N. C., by year's end.

At last...the solution to

really tough

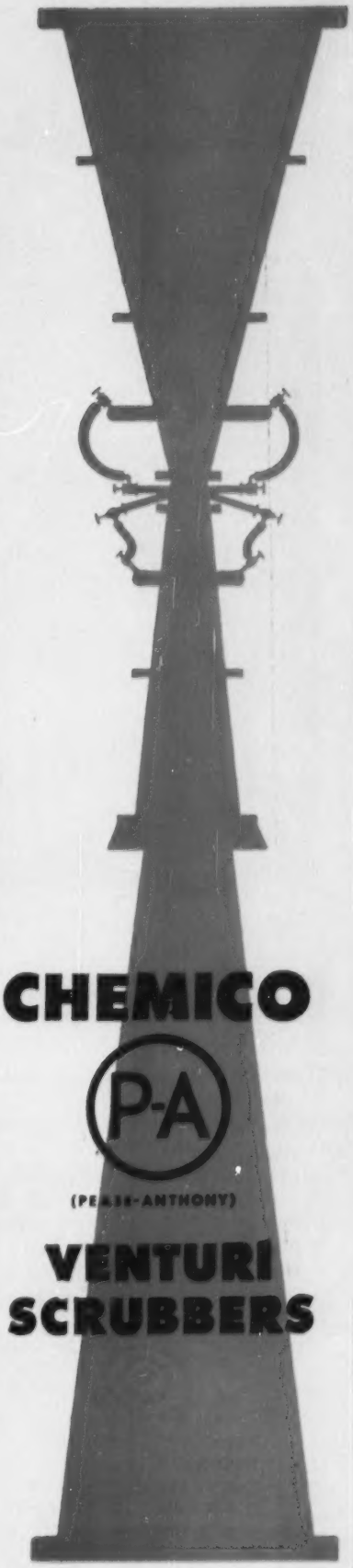
gas-cleaning problems

Sub-micron fumes are the **really tough** gas cleaning problems. These fumes cannot be economically or effectively controlled by conventional cleaning devices.

However, the Chemico P-A Venturi Scrubber is proving its success in solving these **really tough** problems in more than 150 commercial installations and in more than 70 pilot investigations.

The table lists some of these commercial installations. All of these **really tough** problems and many more are being solved with complete satisfaction to users of P-A Venturi Scrubbers.

PROCESS	DUST OR FUME	INSTALLED CAPACITY CFM
Incinerator—Flue Fed	Fly Ash	32,000
Incinerator—Sodium Disposal	Na_2O	9,000
Incinerator—Industrial	Radioactive Dust	6,000
Dry Ice & CO_2 Plants	Amine Recovery	72,400
CO_2 Gas for Process	Fly Ash	500
Boiler Flue Gas	Fly Ash & SO_2	4,300
Enamel Frit Furnace	Dust & HF	11,900
H_2SO_4 Concentrator	H_2SO_4	49,800
Copperas Roasting	H_2SO_4	34,250
Cobalt Ore Roasting	H_2SO_4	65,000
Chemico Wet Type Acid Plant	H_2SO_4	41,000
Chloro-Sulfonic Plant	H_2SO_4	600
Phosphoric Acid Plant	H_3PO_4	91,900
Phosphoric Acid Concentrator	H_3PO_4	194,000
Phosphor Copper Furnace	H_3PO_4	15,000
Smelting—Non-Ferrous		
Blast Furnace	Lead & Organic	12,000
Reverb. Furnace	Lead Compounds	23,500
Comb. Blast & Reverb.	Lead Compounds	7,000
Brass Furnace	Zinc Oxide	7,500
Ajax Furnace	Beryllium Fumes	4,000
Steel Plant		
Oxygen Steel Process	Iron Oxide	140,000
Blast Furnace	Coke & Iron Oxides	788,000
Zinc Sintering	Zinc Oxide	75,000
Wood Distillation	Tar Products	3,500
Na_2SiF_6 Dryer	SiF_4 & Dusts	700
Iron Chloride Concentrator	$FeCl_2$ & HCL Mist	40,000
Unknown	Carbon Black	1,700
Lime Kiln	Lime & Na_2O	18,000
Detergent Spray Dryer	Chemical Fume	250,000
Furfural Residue Burner	Fly Ash	36,000
Nodulizing Kiln	Manganese & Lead	25,000
Aluminum Pot Lines	Tar Fog, Fluorides	40,000
Carbide Furnace	Metal Oxides	1,000
Asphalt Plant	Rock Dust	80,000



Write to our P-A Sales Department for Bulletin M-102 describing the simple operating principle of the P-A Venturi Scrubber, and Bulletin M-103 explaining its metallurgical fume applications in the steel industry.

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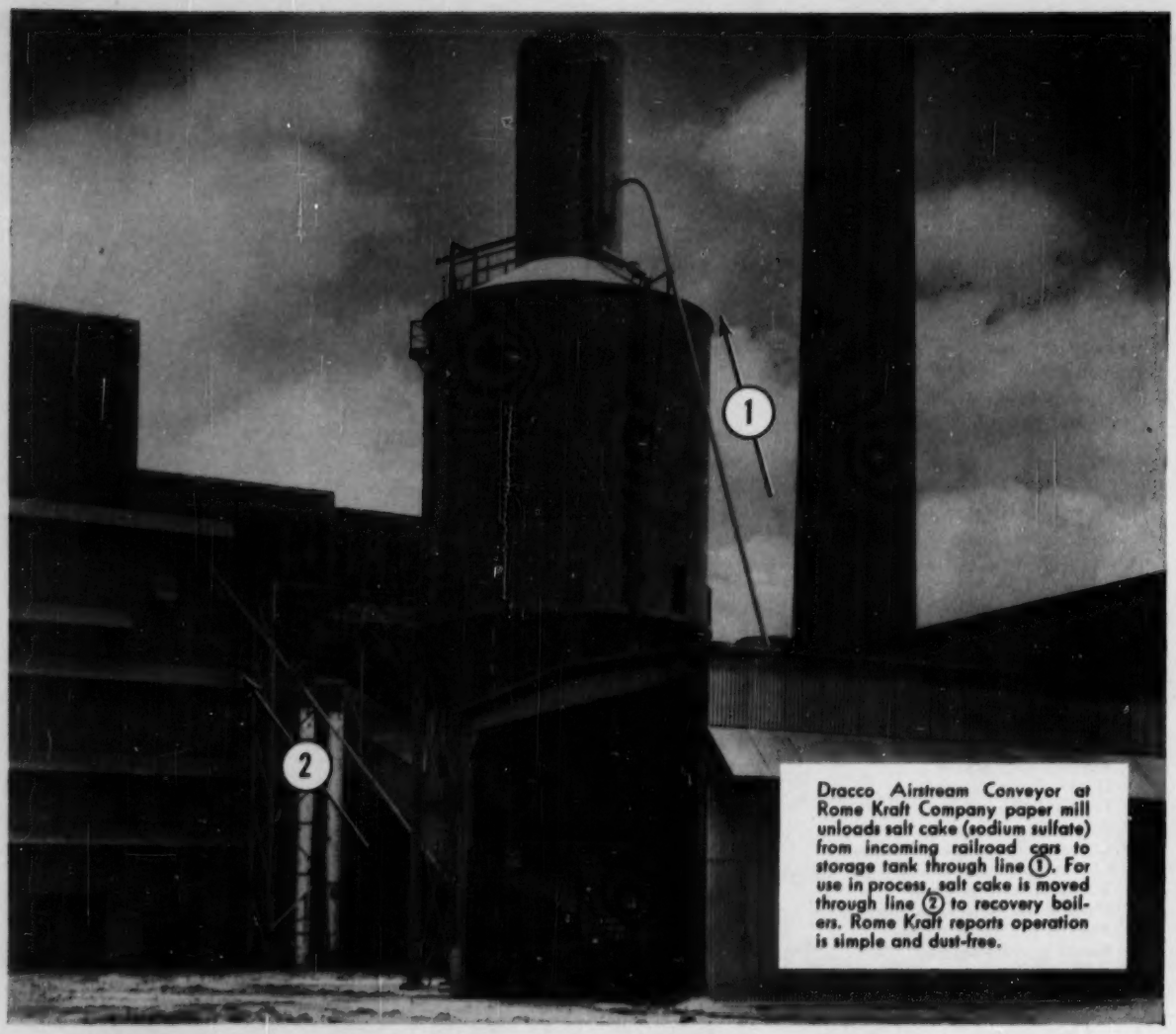

Dracco Airstream Conveyor at Rome Kraft Company paper mill unloads salt cake (sodium sulfate) from incoming railroad cars to storage tank through line ①. For use in process, salt cake is moved through line ② to recovery boilers. Rome Kraft reports operation is simple and dust-free.

one Airstream Conveyor does two handling jobs

The Dracco Airstream Conveyor recently installed by the Rome Kraft Company, Rome, Georgia, performs two separate handling functions. First, salt cake is unloaded from railroad cars to storage; later, when required, it is conveyed from storage to process. Both operations are economically handled by one conveyor —with materials moved by air at 10 tons per hour.

This versatile, low-cost handling is typical of Dracco Airstream Conveyors —the modern method for moving all types of dry, bulk granular, or powdered materials. Air conveying of chemicals, foods, plastics, grains and hundreds of other materials is fast and safe. There is no costly manual handling and one-man supervision is normal. Buying materials in bulk provides added savings.

Dracco Airstream Conveyors can load and unload, distribute to process, transport between plants, and weigh, blend and batch automatically en route. There is no dust, no material loss from spillage or broken bags, no spoilage from moisture and contamination. Their self-cleaning feature permits sanitary handling of foods, allows quick switchover to other materials without intermixing. Systems require minimum space, can be installed in any new or existing plant.

In all these ways, air moves materials better. And *no one moves air better than Dracco.* On your next bulk handling problem, call in Dracco for a cost-saving solution. Write for literature today.

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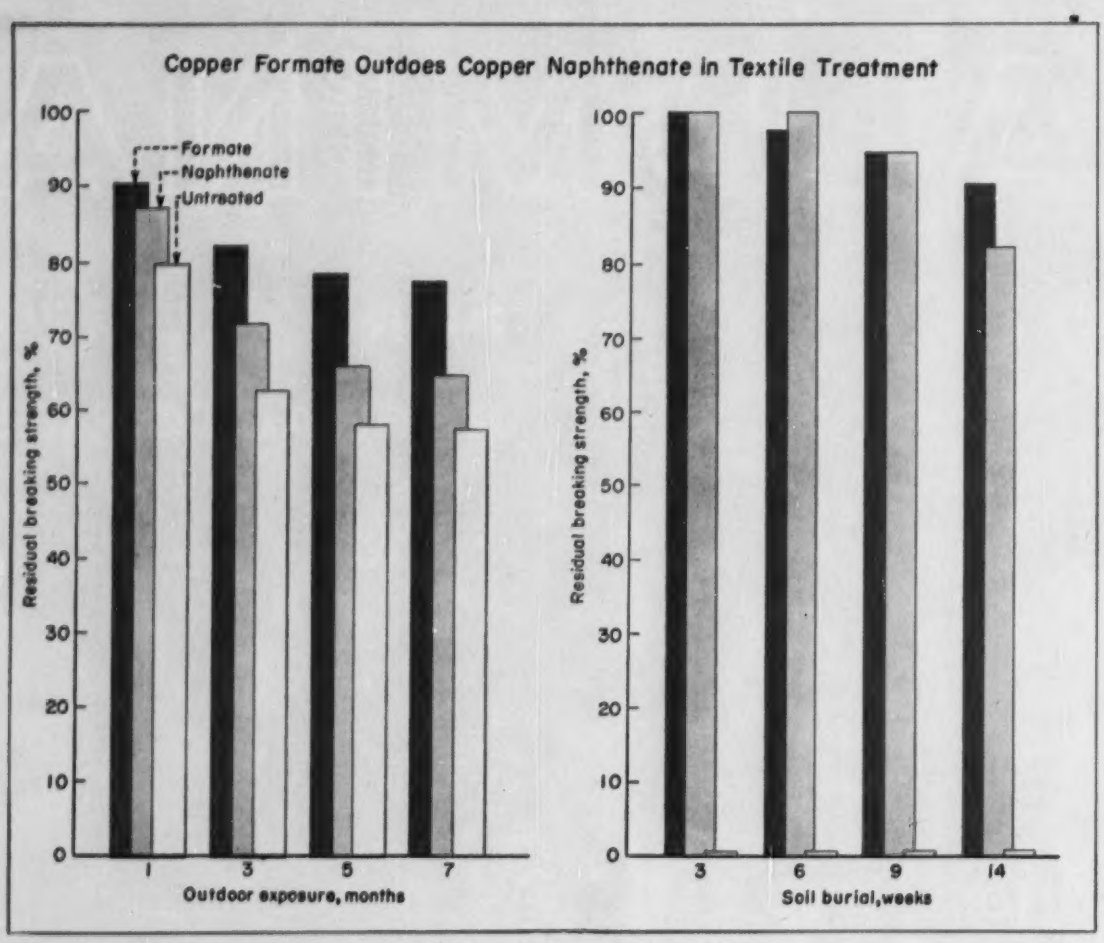

New Preservative Challenges Old Standbys

Copper formate is banking on its outstanding properties to give it a fair share of the markets now held by copper naphthenate (textiles) and cresosote (wood).

Two old standby preservatives—copper naphthenate (textiles) and creosote (wood)—are in for some competition now that National Cylinder Gas has come out with a new preservative process based on the use of copper formate.

For NCG's process is said to do a better job than either the naphthenate or creosote in their respective fields. And all because treatment of either textiles or wood with an aqueous copper formate solution chemically fixes the copper compound to the cellulose molecule, insuring long-time preservation.

▶ **For Cotton, Linen, Rayon** — Application of the new preservative to fabrics involves three simple steps—treating the cloth with copper formate solution, padding to give correct copper pickup, heating (preferably in an autoclave) at 100 to 150 C. for 10 to 60 minutes to convert the copper compound to the insoluble copper complex.

Although such treatment matches copper naphthenate in superior rotproofing and resisttance to leaching, it has the edge over the naphthenate because it:

- Leaves fabrics odorless.
- Imparts a soft hand (feel).
- Causes no irritation to human skin.
- Doesn't affect washing or dyeing qualities of fabrics. (Nat-

Something NEW in large gate valves!

Operating records show that it takes 6 men two hours to open an old-fashioned 72" hand-wheel-actuated gate valve.

The new Semet-Solvay hydraulically-operated 72" valve* can be opened manually by one man in 17 minutes . . . and by a small motor-driven pump in just 2½ minutes!

Semet's new valves have these advantages, too:

- the hydraulic pump, manual or motor-driven, can be located either at the valve, or remotely.
- one small motor-driven pump can be used to serve a group of valves.
- a dial type position indicator is provided and may be located either at the valve or at some remote point.
- each valve is equipped with a mechanical locking device to lock the valve in open position, or, optionally, in any position.
- all operating mechanism is mounted in a completely dust-tight, enclosed yoke.
- a pair of powerful jack screws is provided to release valve gates frozen from disuse.
- two large clean-outs are provided below the gates.
- construction can be of cast iron, cast steel, fabricated steel, or special alloy.
- they are available in gate valve and goggle valve types.

Specialists in designing and fabricating custom-made processing equipment, Semet will provide accurate estimates from your specifications or blueprints. Write to us for additional information.

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*Patents applied for

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Man-made diamonds.....148A
Moldable polystyrene beads.....150A
Formvar-urethane wire coatings.....150B
Natural rubber substitute.....150C
Gallium seals vacuum equipment.....152A
Nitrile rubber resists discoloration.....152B
Five new silicone rubbers.....152C
Silicone rubber meets aeronautical specs..152D
Cobalt-60 gamma-ray sources.....154A
Flake tallow alcohol.....154B
Man-made carbides for milling, cutting....154C
Pressure-sensitive Teflon tape.....154D
Tallow alcohol-based nonionic detergents..154E
Fertilizer and insecticide emulsifiers.....154F
Itaconic acid in two grades.....154G
Organic mercurial seed disinfectant.....154H
Phthalocyanine green toner.....154I

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ural color of fabric changes to light tan on formate treatment compared with dark green with naphthenate.)

• Eliminates fabric impregnation via expensive, hazardous organic solvents.

▶ **Tests Prove Superiority** — Added proof of copper formate's superiority is available from results of tests for resistance to weathering and microbiological attack.

After seven months of outdoor weathering, breaking strength of NCG-treated fabric is 20% greater than naphthenate-treated cloth, 30% greater than untreated cloth. And after 200 hours of artificial weathering (exposure to the intense rays of a carbon arc lamp, with alternate wetting and drying), breaking strength of NCG-treated canvas is unaffected.

Soil burial tests (strips of fabric buried in fertile soil containing rotting and decaying agents) produce equally good results. While formate-treated cottons maintain nearly all (about 95%) of their breaking strength after 14 weeks, naphthenate-treated fabrics lose about 15% of their breaking strength in the same period. And untreated cotton fabrics completely disintegrate within 7 to 14 days of soil burial.

▶ **Pay-Off in Wood, Too**—As in fabric treatment, wood impregnation with copper formate is simple—following the currently accepted full-cell method for water-borne preservatives.* After impregnation, copper is chemically fixed to the wood cellulose by heating with steam under presure at 100 to 150 C. for ½ to 6 hours (depending on wood size) or curing at high temperatures for a similar time period.

Results of such treatment open up possible applications for formate-treated woods which have been closed to creosote-treated timber. For aside from the odorless, non-toxic and non-irritating aspects of formate-treated wood, it has these added advantages over creosote impregnation:

• Clean and oil-free. Wood can be laminated, painted or glued.

• Non-leachable (because of chemical tie between copper and cellulose). Ideal for outdoor use—in ships, boats, docks, pilings and other structures exposed to marine borers in salt water.

▶ **Outdoor Tests Successful** — Long-term tests (conducted in Biscayne Bay, Florida) show that panels impregnated with less than 20 lb. of creosote per cu. ft. are attacked, some completely destroyed. NCG-treated panels, on the other hand, are unaffected. And accelerated leaching in hot sea water indicates that at least 30 to 40 years exposure won't decrease the copper content of NCG samples below the limit that protects the wood.

Formate-treated woods afford excellent protection in soil burial tests, too, showing about 1% decay over 9 months compared with 50-80% (depending on the type of wood) for untreated lumber.

▶ **Present and Future**—Within the next few months, the new fungicide will be made available to both the textile and wood industries at costs competitive with preservatives now on the market.

But long-range plans call for copper formate to invade other fields. Next on the list: paper—for protection against mildew and rot by destroying cellulosic bacteria.—**National Cylinder Gas Co., Chicago 11, Ill.** 146A

*A preliminary vacuum is pulled on the wood, followed by addition of preservative and pressure application. When no more preservative can be forced into the timber, pressure is released and the pressure cylinder drained.

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Man-Made Diamonds

One step nearer to commercial production.

Now that man-made industrial diamonds are being produced in limited quantities, General Electric is one step closer to its two-fold goal of making these diamonds commercially available at a marketable price.

Supply of industrial diamonds is essential to U. S. industry—largely for finishing interchangeable parts which must be held to close tolerances and for shaping and dressing grind-

SAFETY IS WELL IN HAND . . .

when you preserve with PARASEPTS®

Here is your solution to the problem of *safe* and effective preservation of products vulnerable to fungal and bacterial attack. By preventing the growth of such microorganisms, Heyden Parasepts eliminate costly breakdown, resultant malodor and discoloration of your product.

Harmless and non-irritating to the skin, the Parasepts find wide use in creams, lotions and other cosmetics; also in finger paints, tooth pastes and antibiotics where a low level of toxicity is required.

As non-ionic, neutral esters, Parasepts may be used in combination with other preservatives to achieve protection with maximum safety.

You will benefit from these outstanding advantages of the Parasepts:

- **Colorless, odorless and tasteless in recommended concentrations.**
- **Non-irritating to skin; extremely low toxicity.**
- **Economical—effective in low concentrations.**

Heyden offers Methyl, Ethyl, Propyl, and Butyl Parasepts in purified and technical grades to meet your specific requirements.

Write for Bulletin PSPT-1 and detailed technical information.

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ing wheels that produce these tolerances.

In an emergency, if the source of natural stones (South Africa) were cut off, many of our key industrial processes would be seriously handicapped. But a domestic source of man-made diamonds, such as G.E. envisions, would help make the U. S. independent of the natural source.

And if the cost of man-made diamonds can be brought down below those now being mined, industrial diamonds could become a $200 million annual business within the next decade.—**Carboloy Dept., General Electric Co., Detroit 32, Mich. 148A**

Urethane Wire Coatings

Don't have to be stripped before soldering.

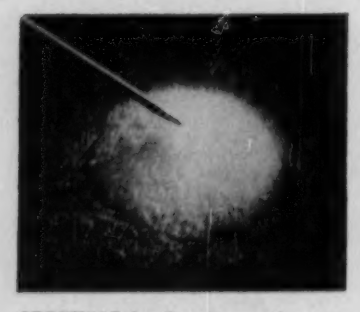
Latest wire insulating material entering the field of competition against traditional Formvar-phenolics (polyvinyl formal plus alkyl phenolic modifier) is Formvar-urethane.

Chemically, the new material differs from Formvar-phenolics in that an isocyanate (Monsanto's Mondur-S) replaces the phenolic resin in the formulation. Physically, there's much to be said for Formvar-urethane coatings:

- Don't have to be stripped off wires that are to be soldered. Urethane bond breaks at soldering temperatures (360 C.), leaving a clean wire surface.
- Equal or excel Formvar-phenolics with regard to electrical properties and resistance to heat and water. They show outstanding resistance to thermoplastic flow and effect of refrigerants, have very low extractible content.

While meeting the generally accepted specifications of the magnet wire industry, performance of Formvar-urethane coatings don't entirely equal Formvar-phenolics with respect to flexibility, adhesion, resistance to abrasion, heat shock and solvents.

New enamels are not intended as general replacement for Formvar-phenolics. They're aimed at certain specialized applications.—**Shawinigan Resins Corp., Springfield 2, Mass. 150B**



ORIGINAL beads are sometimes . . .

PRE-EXPANDED before . . .

Molding Polystyrene Beads Into Any Shape

German-developed polystyrene foam now being made in this country.

A German-developed polystyrene foam will soon be available on the domestic market, now that a U. S. firm has obtained a license for its production.

The new product, to be known as Uni-Crest, is basically identical to and possesses properties similar to that of Styrofoam. But it has added advantages, chief of which is that it can be molded into any shape or form. (Styrofoam is shaped by mechanical means—turning, etc.)

The finished product is made from beads resembling coarse sugar grains. Whether the beads are used in their original form or pre-expanded to slightly larger size depends on the type of molding and the density of the form desired.

When expanded and welded together, the beads form a homogeneous, snow-white product composed of minute individually closed cells. This product is extremely lightweight, ranging from 1-20 lb./cu. ft. Heat transfer rate is exceptionally low and moisture absorption is less than 1% even after days of total submergence. Its coefficient of expansion is small, approximately that of tin.

Uni-Crest can be laminated with wood, steel, aluminum, plastic, etc. It's odorless, nontoxic, non-friable, vermin resistant, easy to cut. It will be available in molded slab, brick or block form in lengths up to 12 ft., widths up to 4 ft. and thicknesses up to 8 in. It will also be molded to specification in varying shapes, sizes and densities.

Biggest markets will be insulations, packaging and display materials, floatation products (life rings and preservers, buoys, etc.).—**United Cork Companies, Kearny, N. J. 150A**

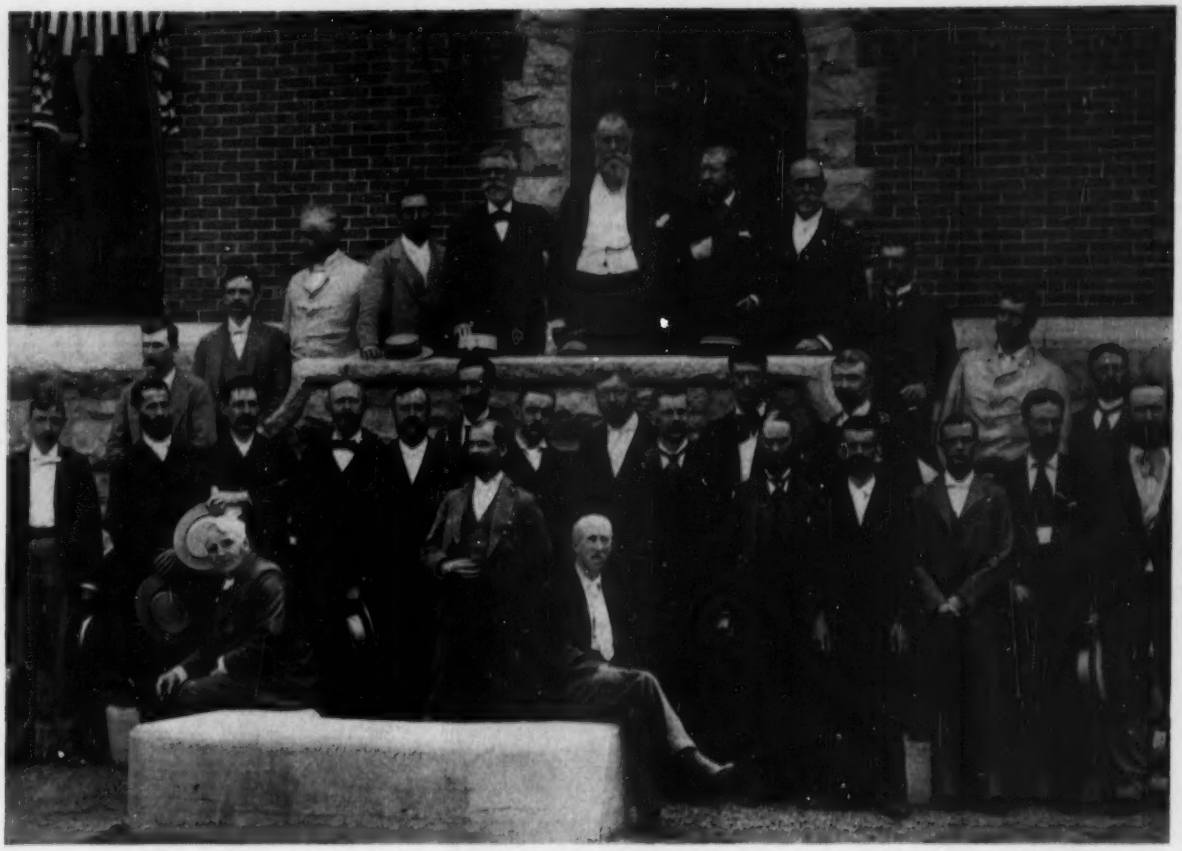
Synthetic Rubbers

Four different companies offer eight varieties—one butadiene, one nitrile, six silicones.

Again this month, we find that activity in the synthetic rubber field is moving along at a merry clip.

- Phillips Petroleum Co.'s new cis 1,4 polybutadiene gives promise of providing an economic alternate for natural rubber in many uses. Heat buildup of this rubber in the Goodrich flexometer is 20 F. below that of standard GR-S cold rubber. Resilience is 10-15% better than GR-S and freeze point is about −160 F., some 90 degrees better than GR-S.

Unlike emulsion polymerized butadiene, the new rubber is easily compounded by standard techniques, has excellent balance of other physical proper-



THEY STARTED THE AMERICAN ALKALI INDUSTRY

These men of Solvay · · · 75 years ago!

Marking our 75th Anniversary this year, we take pride in Solvay's pioneer role in the establishment and development of the American Alkali Industry. But, at Solvay we do not think of pioneering as a picture from the past but as a continuing job for today and the years ahead.

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ties. Infra-red studies confirm that the material is better than 90% of the cis polymer with small amounts of trans 1,4 and 1,2 addition.

In addition to the synthesis of natural rubber's synthetic counterpart, Phillips has also synthesized trans 1,4 polyisoprene, the synthetic counterpart of gutta percha and balata. Economics of this latter development may open up new uses for this material, which has been expensive to obtain from natural sources. 150C

• To meet the increasing demand by industry for oil-resistant rubbers in applications where color or non-staining properties are of prime importance, Goodyear Tire and Rubber Co. has developed an improved, light-colored nitrile rubber, Chemigum N6B.

By using a new and improved antioxidant system, N6B becomes a non-staining, non-discoloring version of the standard Chemigum N6. Both products are about equal in physical and gum properties and extremely close in compounded properties before and after aging. But the new rubber has an added advantage — superior resistance to discoloration.

Color characteristics of N6B make it ideal for light-colored applications like flooring, clear cements and applications where resistance to ultraviolet light of photochemical degradation is needed 152B

• General Electric has added five new silicone rubbers to its standard line of products—three having the same shrinkage as organic rubber, two designed specifically for the production of expanded unicellular (sponge) silicone rubber.

The first three compounds, SE-361, SE-371, SE-381, make possible, for the first time, the molding of silicone rubber parts in the same molds used for organic rubber parts. They also permit specification of closer tolerances with silicone rubber.

A cost saving feature is the improvement of curing times. All three compounds may be cured equally well by mold, air vulcanization or steam methods.

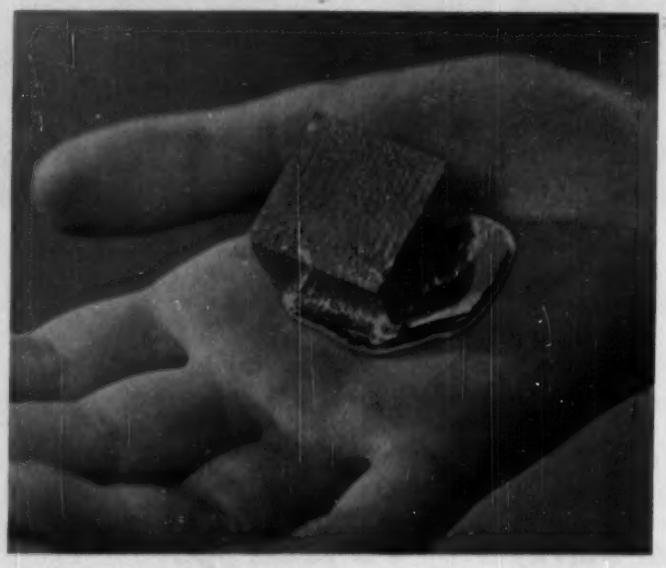
The two materials designed as sponge compounds, 81597 and 81601, allow greater flexibility in production operations by the greatly increased time lapse between the freshening-forming step and the cure—with little or no loss in resulting expansion. Freshened life ranges from 8-24 hr.

For easier handling, uniform product and better sponging properties, both 81597 and 81601 are furnished without blowing agents. (The fabricator incorporates the blowing agent during freshening.) Sponge made from these compounds may be used at temperatures as low as −120 F. and as high as 500 F. 152C

• Newest member of Union Carbide and Carbon's growing family of silicone compounds is X-1034R silicone rubber compound.

An outstanding feature of X-1034R is that it fully meets the requirements of Aeronautical Materials Specification 3301B, something no previously available compound has been able to do. Thus fabricators can manufacture parts to this spec without compromising on properties or obtaining waivers from customers.

Red-colored X-1034R is easy to handle, exhibits excellent resistance to high temperatures,



Not Butter, But Gallium

A promising new application for gallium — the metal that melts in your hand—is as a sealant in the many glass joints and valves in laboratory vacuum equipment.

This new market for the long available, but seldom used, wonder metal makes possible the redesign of vacuum equipment to afford simplification and lower operating cost.

Simplified operation: Gallium, unlike the widely used silicone grease sealants, doesn't evaporate at high vacuums and isn't dissolved by cleaning solution. A liquid at 86.5 F., it's easily inserted in the joint sleeve and clings instantly to the glass surface. At it cools to room temperature, it becomes solid and expands, forming a perfect seal.

Lower cost: Gallium's low melting point simplifies equipment dismantling and reassembling. And elimination of repeated dismantlings — to clean and reseal leaky joints—promises to reduce operating costs.— Aluminum Co. of America, Pittsburgh, Pa. 152A

The Motor you asked for!

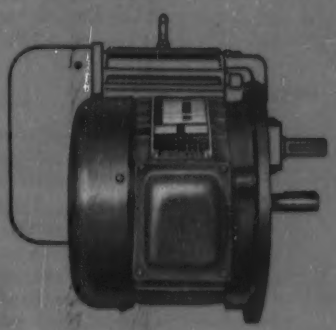
Non-Ventilated

TAKES less space... because it's the new FLAT-Type Motor

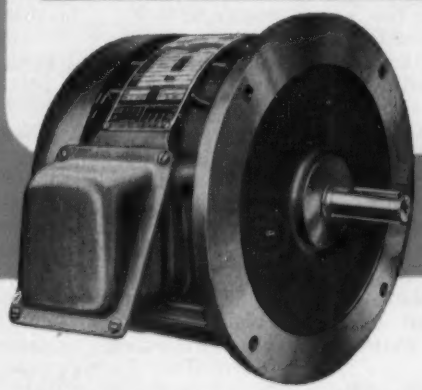
GIVES more service... because it's a DIEHL

FOR SIZE AND WEIGHT, COMPARE THE NEW FLAT-TYPE WITH STANDARD MOTORS

FRAME SIZE		OVERALL LENGTH (Inches)			APPROXIMATE NET WEIGHT (Lbs.)		
Standard	Flat-Type	Standard	Flat-Type	Saving	Standard	Flat-Type	Saving
DIF 182	DIF 180	14⅛	10¾	3⅜	82	59	23
DIF 213	DIF 220	17⅜	11⅝	5⅝	128	83	45
DIF 284U	DIF 280	26	13 13/16	12⅜	272	135	137



New Flat-Type superimposed on standard motor



Fan Cooled

The unique and perfect answer in *integral motors*—designed especially for the machine tool and equipment industries. Packs full horsepower in less space . . . actually up to 48% shorter than standard motors without sacrifice in performance. Many pounds lighter, too, than conventional motors (over 50% in some cases), meaning vastly reduced over-hung weight. Standard radial construction, easy to disassemble and reassemble . . . no precision alignments or complicated air-gap adjustments to contend with. Totally-enclosed . . . no dirt, dust or moisture can get in. Available (non-ventilated) in ratings to 3 H.P., and (fan-cooled) in ratings to 20 H.P.

Perhaps the Diehl Flat-Type Motor is just what you need to solve your application problems. Give us the details and we'll be glad to submit recommendations. Ask for your copy of Bulletin CE-3461

Diehl

DIEHL MANUFACTURING COMPANY 7-56

Electrical Division of THE SINGER MANUFACTURING COMPANY

Finderne Plant, SOMERVILLE, NEW JERSEY

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has very low compression set and low moisture pickup. It can be molded, extruded or calendered with conventional or special catalysts. With di-tertiary-butyl peroxide (DTBP) it can be used for thick sections.

Along with its development of X-1034R, Carbide has also announced a safe and easy-to-use catalyst, X-1960 silicone rubber curing compound. This stiff, white paste contains a combination of silicone rubber gum, filler and 5% DTBP which is locked into the formulation so that it can't evaporate.

The new catalyst is designed to minimize precautions which must be taken with liquid DTBP itself (it produces fumes which may lead to flash fires). Carbide stresses that X-1960 is recommended only for curing Carbide silicone rubber compounds and is not for use with regular dimethyl silicone rubbers. 152D

Briefs

Cobalt-60 gamma-ray sources, widely used in industrial plants for non-destructive inspection of material for flaws, is latest addition in manufacturer's line of radioactive materials. Sources are enclosed in a case, sealed against leakage and individually calibrated to within ±10% of stated value. They provide an economical source of high energy, pure gamma radiation and are available in 14 different values from 1 millicurie to 2,000 millicuries. — **Nuclear Instrument and Chemical Corp., Chicago 10, Ill.** 154A

Flake form tallow alcohol, Sipon TX, is claimed to be the lowest cost fatty acid on the U.S. market. Already finding use as a detergent intermediate, foam depressant and emolient, it also holds promise as a building block for manufacture of lube oil additives (pour point depressants, viscosity index improvers) and as a raw material in the synthesis of polymerization modifiers and emulsifiers.—**American Alcolac Corp., Baltimore, Md.** 154B

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Two man-made carbides have been developed—one, for milling high-strength cast iron; the other, for precision cutting steel. Grade 860, for milling, lasts 20-30% longer in machining high-strength cast irons such as used in the automotive industry. Grade 330, said to be almost twice as tough as commonly used carbides for fine precision cutting steel, has a reported transverse rupture strength of 200,000 psi. — **Carboloy Dept., General Electric Co., Detroit, Mich.** 154C

Pressure-sensitive Teflon tape defies action of many reactive chemicals (e.g., 3% and 30% H_2SO_4, 10% NaCl, 1% NaOH), resists corrosion and is unaffected by temperatures ranging from −65 to 400 F. Called No. 549, the semi-transparent, blue-gray tape is made in both 3½- and 6½-mil thickness consisting of 2- and 5-mil films coated with 1½ mils of silicone adhesive. Tape is available in ½- to 5-in. widths on 36-yd. rolls.—**Minnesota Mining & Manufacturing Co., St. Paul 6, Minn.** 154D

Nonionic detergents, based on low-cost tallow alcohol, are priced 20-50% below conventional fatty alcohol nonionics. Designated Siponic E-1 through E-5, these white, waxy solids range from oil soluble to water soluble, are heat stable and resist concentrated acid and alkali. Siponics aren't expected to compete with nonionics in general, but are being tested for specific applications, e.g., pigment dispersing agents; components of textile auxiliaries; ingredients in low-foaming, heavy-duty detergents. — **American Alcolac Corp., Baltimore, Md.** 154E

Two emulsifiers, Emcol H-A and Emcol H-B, are said to allow farmers—for the first time—to mix liquid fertilizers and emulsifiable insecticide concentrates properly in the field. Both products permit a wide range of insecticides to be mixed with all types of liquid fertilizers. Compatible mixtures can be made between Aldrin, BHC (benzene hexachloride), chlordane, dieldrin, endrin heptachlor and nemagon, liquid fertilizer solutions.—**Emulsol Chemical Corp., Chicago 5, Ill.** 154F

Itaconic acid is now available in two grades, pure and technical. Price of pure acid has been cut from 60¢/lb. to 54¢/lb., technical grade is 44¢/lb. —both in carload lots. In addition, two new itaconic acid esters —diallyl and monoallyl itaconate—are being offered to industry on a research basis (for possible application in plastics manufacture). — **Chas. Pfizer & Co., Inc., Brooklyn 6, N. Y.** 154G

Organic mercurial seed disinfectant, Ceresan, is being marketed in liquid form—in varying concentrations. New formulations not only retain both the fumigating and residual action of the dry compounds, but also offer the convenience of liquid and the safety factor of a dye which colors the treated seed. Liquids have little or no tendency to corrode machinery or cause skin irritation. They're available in 5, 30 and 55 gallons.—**E. I. du Pont de Nemours & Co., Wilmington 98, Del.** 154H

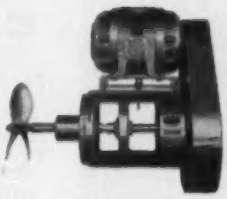
Phthalocyanine green toner, Cyan Green Toner 15-3100, has excellent working properties, good ease of dispersion and freedom from bodying in protective coating formulations. It's essentially non-bleeding in organic solvents, shows excellent stability in both acid and alkaline media. It should prove useful as a blending color with suitable yellows to produce varying shades of stable greens.—**American Cyanamid Co., New York 20, N. Y.** 154I

With NETTCO:
THE JOB
DICTATES
THE
DRIVE!

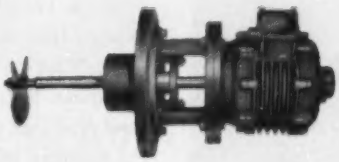
KBA Side Drive with Standard Belt Drive.

Nettco Agitation Engineers can help you get the right side drive agitator for your particular process. The Nettco line of side drive agitators offers a wide range of sizes, motor mounts, speed reduction designs, and stuffing box modifications. Standard units are available in the full range of horsepowers from ⅓ to 30. Frames, shafts, and propellers can be supplied in alloys to meet process conditions. **For detailed information on side drives ask for Bulletin No. 532.**

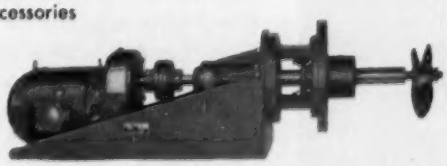
Let Nettco help solve your agitating problems — with side drive or top entering agitators, with Nettco Flomix® pipe line agitators, with agitator fittings and accessories of all types. We'll be glad to quote on your requirements. New England Tank & Tower Co., 87 Tileston Street, Everett 49, Mass.



KBA Side Drive with Special Motor Mount.

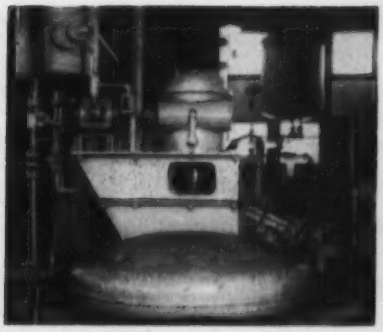


KMA Direct Motor Driven Side Drive.



KBA Gearmotor Driven Side Drive.

NETTCO
ENGINEERED AGITATION



Nettco Model WT Agitator in modern processing plant — an engineered combination of Nettco's standardized units assembled to handle the special mixing requirements of this leading dyestuffs manufacturer. The complete line of Nettco tank top, side entering, and pipe line mixers, and Nettco agitator accessories is described in our Bulletin 551. Write for your copy today.

New wide line of portable and tripod mixers in capacities from 1/6 to 2 HP . . . in high speed (1800 RPM) or medium speed (420 RPM) ranges. Feature high efficiency — leakproof housings — adaptability to sanitary installations. Open, totally enclosed, and explosion-proof motors available . . . in all standard speeds. Request complete data.

Nettco Flomix serving in the production of glycerine at a petrochemical processing plant. Write today for your copy of Bulletin No. 531 describing Flomix.

No. 1 on the List

for small forged steel gate valve jobs

CHAPMAN LIST 960

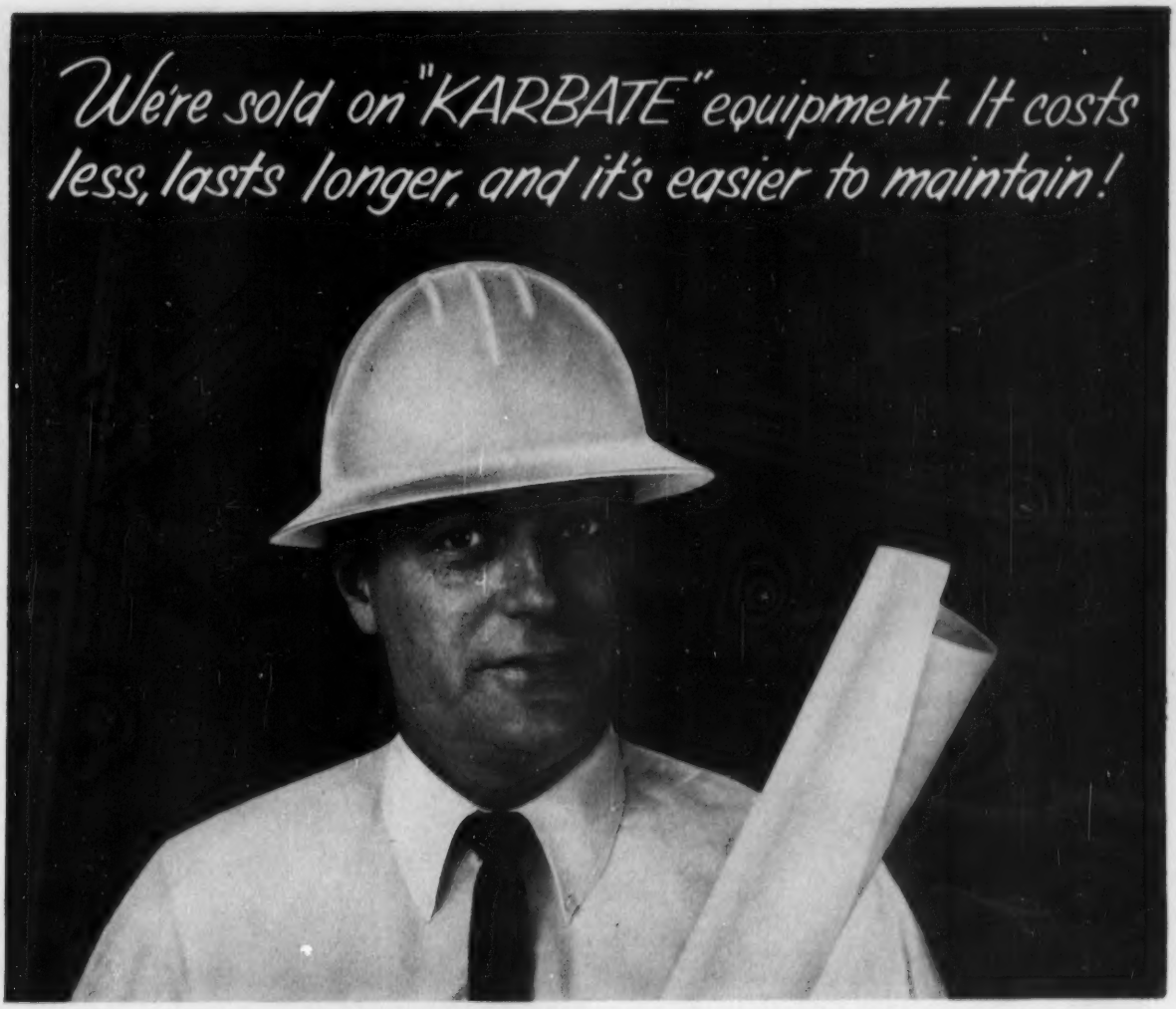
You'll find more Chapman List 960 valves on more jobs than other small forged steel gate valves. For standing up and keeping maintenance costs down it's tops, by far, on the valve man's preference list. The reasons are sound and several.

Wedge gate faces are super hard . . . hardened to 800 Brinell by Chapman's exclusive Malcomizing process. They won't . . . *they can't* seize or gall. Easily replaceable seat rings are hardened stainless steel. Wear on seating surfaces is brought to a minimum. Bolted follower on the outside screw rising stem type has no exposed threads on its yoke . . . nothing that's easy to corrode.

Made to take . . . and stand up under . . . pressures from 380 psi at 1000° F. to 2000 psi at 100° F. (For higher ratings use Chapman List 990 valves.) Sizes from ¼" to 2" in many different alloys. You can have either rising stem with yoke or rising stem with inside screw. And, depending upon your needs, the Bonnet joint is either ground metal-to-metal or gasketed.

Catalog 10 has full information. It's required reading for men interested in valves. Write for your copy today.

THE CHAPMAN VALVE MANUFACTURING CO.
INDIAN ORCHARD, MASSACHUSETTS



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"KARBATE" IMPERVIOUS GRAPHITE PROCESS EQUIPMENT

- Lower first cost
- *Sustained* low maintenance
- Immunity to thermal shock
- High thermal conductivity
- Rugged mechanical designs
- No metallic contamination
- Ease of installation
- Light weight
- Quick delivery
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- Outstanding corrosion resistance

No other material of construction combines all the advantages of "Karbate" brand impervious graphite.

Think of "Karbate" equipment *first* for new plant and expansion; consider it *always* where corrosion is a factor.

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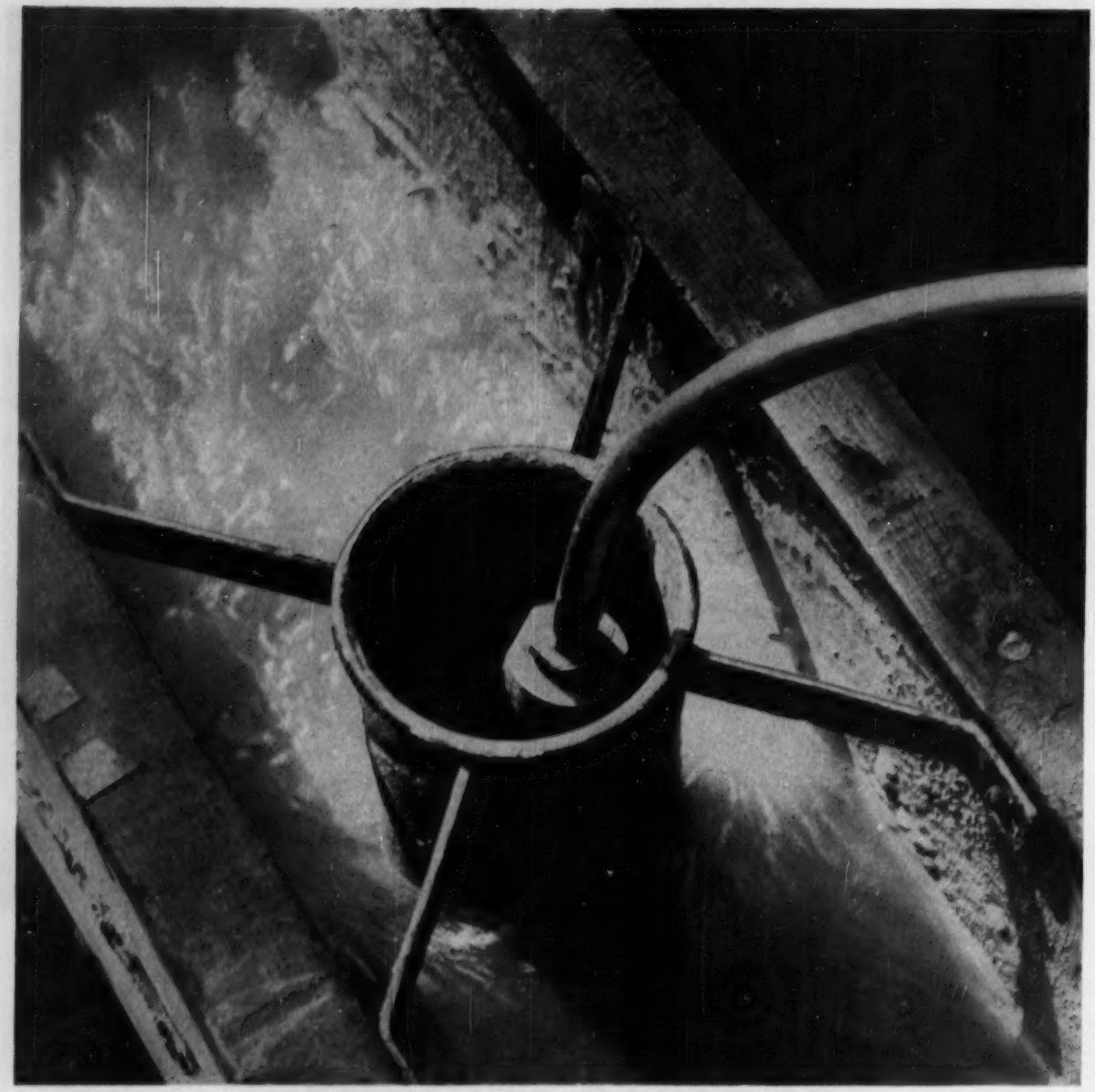


This effluent is controlled at pH 7

. . . as it flows into a creek in northern Pennsylvania, from a large H_2SO_4 plant. It always meets State "clean streams" requirements for industrial wastes because of its L&N pH Control System which includes Speedomax recorder, L&N Control Unit, Valve Drive Mechanism, and pH electrode assemblies like this flume-mounted unit.

The first step in applying this close control is L&N's pH Controllability Analysis. This unique appraisal of the process's controllability factors (type of waste, variations in flow and concentration, etc.) tells us whether your presently-installed treating process is actually controllable within the limits you impose, and if not, what must be done to *make* it controllable. Then we translate these data into the answers you need to engineer an efficient treatment system.

Process Data Sheet 700(2), "L&N Speedomax Control of Plant Waste Disposal Processes," explains this unique and successful approach to waste treatment. Write Leeds & Northrup Company, 4916 Stenton Ave., Phila. 44, Penna.

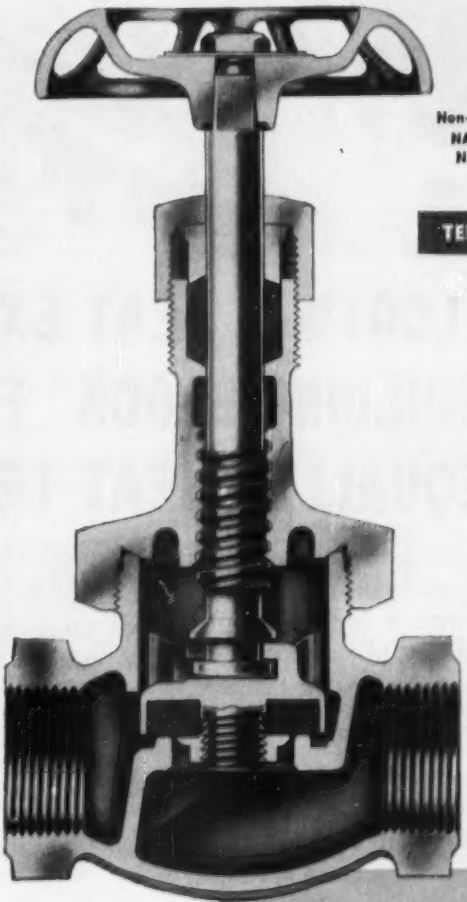
LEEDS & NORTHRUP
instruments • automatic controls • furnaces

These "Hospital Valves" for **OXYGEN** now serve many industrial needs . . . JENKINS Bronze Globe and Angle with **TEFLON** disc and packing

Jenkins Figs. 504 and 505 Bronze Globe and Angle Hospital Valves were designed for the critical requirements of controlling oxygen, nitrous oxide, or any non-flammable gases in hospital services. Industry was quick to note the unique advantages, and they are frequently specified for systems carrying gaseous fluids for heating, cooling, lighting, and processing, where pressure does not exceed 400 psi, or temperature a maximum of 150° F.

Fitted and tested to comply fully with all Association specifications for hospital services, they have the "extra value" construction throughout that is assured by Jenkins quality standards.

Get details—find out how these valves can improve efficiency and economy in your hookups for critical service. They are another example of the broad range of "valves for every service" in Jenkins' complete line.



Complies fully with "Standards for Non-Flammable Medical Gas Systems" of—
NATIONAL FIRE PROTECTION ASSOCIATION
NATIONAL BOARD OF FIRE UNDERWRITERS
AMERICAN HOSPITAL ASSOCIATION

TEFLON Disc and Packing

DuPont "Teflon" is a tough, "waxy" inert solid, gray-white in color, tasteless and odorless, non-adhesive and frictionless. Teflon's high resilience assures perfect contact of disc with lapped, crowned seat for gastight closure. Packing is one-piece ring of Teflon, provides dependable leak-proof seal with light compression.

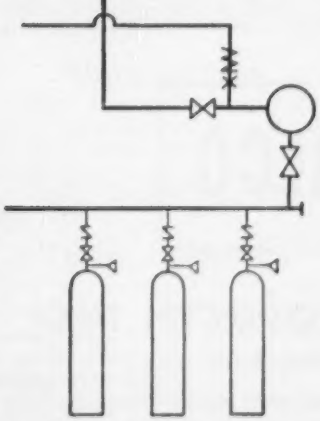
Reinforced Body Casting
High strength bronze body is ribbed along bottom centerline providing extremely high factor of safety. Guards against distortion from vibration, shock, or pipe strains.

Degreased
All bronze parts are thoroughly degreased before assembly.

Polished Spindle
Alloy bronze spindle is polished to permit easy turning and assure leak-proof seal.

Patterns
Globe Fig. 504, Angle Fig. 505

Sizes and Pressure
¼" to 2" 400 lb. O.W.G.



GET COMPLETE INFORMATION from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 116.

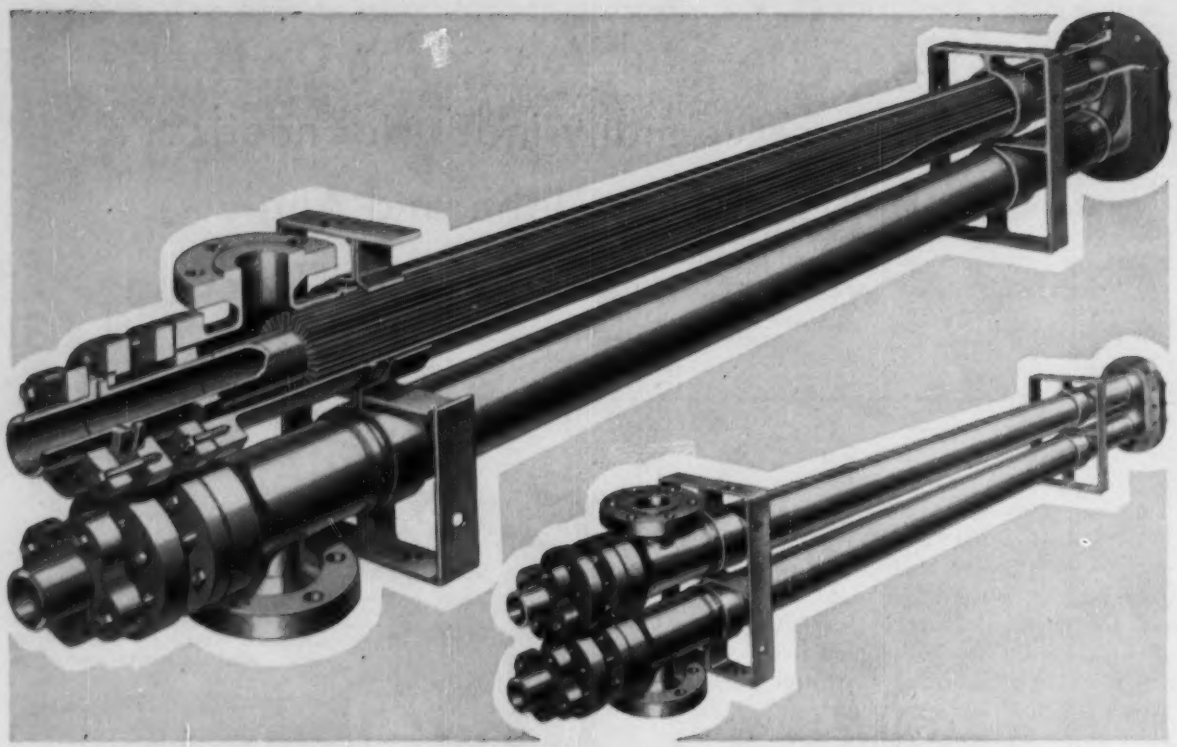
JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SINCE 1864 TRADE MARK JENKINS REG. U.S. PAT. OFF.

Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE



NEW ALCOTWIN HEAT EXCHANGERS GIVE "BUILDING BLOCK" FLEXIBILITY, UNEQUALLED HEAT TRANSFER

ALCOTWIN heat exchangers provide economical, high performance in package form. Their double-pipe fin tubes, with a high ratio of extended surface, make them particularly adapted to water-cooled or vapor-heated services.

Easily arranged and supplemented, ALCOTWINS readily meet changing load and process requirements. Unlike conventional shell-and-tube heat exchangers, they never become obsolete.

Standardized design of the ALCOTWIN allows custom selection of metallurgy for specific service, with the economy and availability provided by "off the shelf" standard parts.

Complete data is available from any of ALCO's sales offices. Or write P. O. Box 1065, Schenectady 1, N. Y., for brochure.

ALCO LONGITUDINAL FIN TUBES

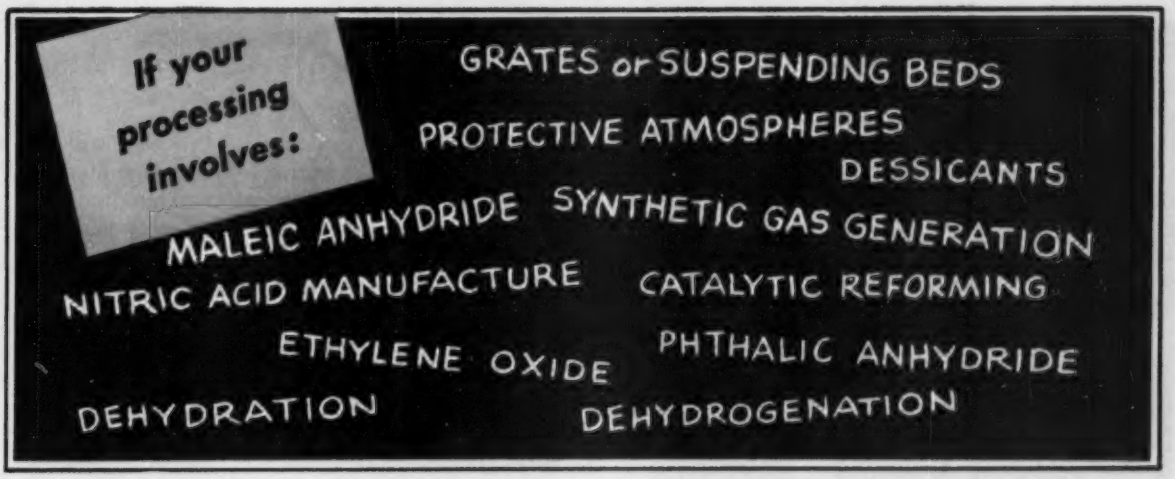
Unequalled heat-transfer characteristics result from the fused metal-to-metal bond between the "U" shaped fin channels and the tube. ALCO's heliarc welding techniques provide a continuous, even bond resulting in higher efficiency.

ALCO

ALCO PRODUCTS, INC.

New York

Sales Offices in Principal Cities



You can benefit by using ALUNDUM* catalyst carriers

More and more chemical engineers are finding in Norton ALUNDUM catalyst carriers the R's they need for faster, better, lower cost production in a wide range of processing.

These fused alumina carriers are characterized by excellent mechanical, thermal and chemical stability. They have high resistance to abrasion and erosion, and their low density is useful for packing and filling applications. Catalytically, they are crystalline in nature and are produced in two surface area types: low and intermediate. Intermediate surface area carriers are subdivided into types A, B, and C, with varying characteristics.

TYPICAL CHEMICAL ANALYSES (%'s)		
	LOW SURFACE AREA	INTERMEDIATE SURFACE AREA
Al_2O_3	89.4–76.6	77.0
SiO_2	9.3–16.8	21.2
Fe_2O_3	0.5 – 1.3	0.2
MgO	0.1 – 0.6	0.4
CaO	0.1 – 0.8	
Na_2O	0.3 – 0.4	0.5
K_2O	0.1 – 1.0	0.2
TiO_2	0.2 – 2.5	0.5

PHYSICAL PROPERTIES						
	Porosity	Water Absorption	Bulk Density	Vol. Bulk Density	Crystal Structure	Surface Area
Low Surface Area	40-50%	20-25%	1.90-2.10 gr/cc	65-80 lbs/ft³	Alpha Alumina	Less than 1m²/gram
Intermediate Surface Area Type A	50-55%	28-30%	1.65-1.70 gr/cc	58 lbs/ft³ (app)	Alpha, Gamma Alumina-chiefly Gamma	60-70m²/gram
Type B	50-55%	28-30%	1.65-1.70 gr/cc	60 lbs/ft³ (app)	Quartz, Alpha, Kappa, Delta Alumina-chiefly Quartz	20-30m²/gram
Type C	50-55%	28-30%	1.65-1.70 gr/cc	62 lbs/ft³ (app)	Alpha Alumina and Mullite	5-10m²/gram

Shapes and Sizes

Spheres: (Low surface area) 1/16"-1" diam; (Intermediate surface area) 1/4"-1/2" diam. *Pellets:* (All carriers) 1/8" x 1/8"-1/2" x 1/2". *Rings:* (All carriers) 1/8" x 1/4" x 3/8" O.D.-1" x 1 1/2" x 1 1/2" O.D.

Typical Applications

Low Surface Area Carriers: phthalic anhydride, maleic anhydride, ethylene oxide, protective atmospheres, synthetic gas generation, grates or suspending beds for active catalysts.

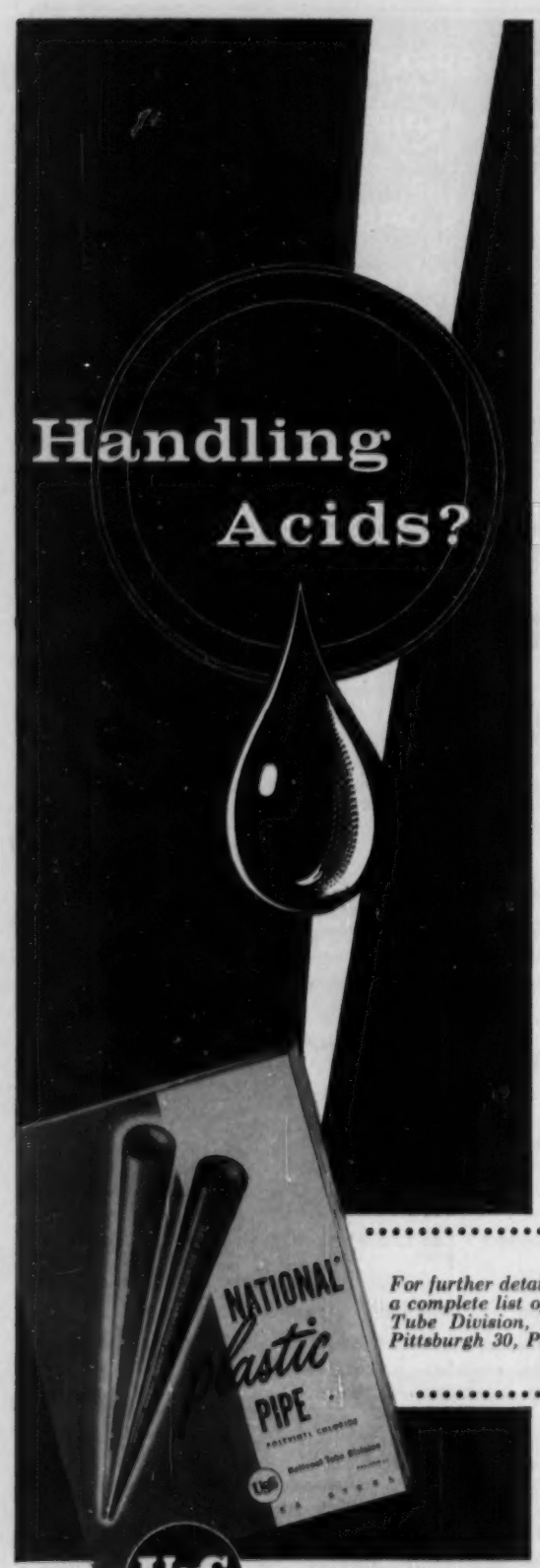
Intermediate Surface Area Carriers: catalytic reforming, dehydrogenation, dehydration, sulfuric acid manufacture, nitric acid manufacture, dessicants.

Get More Facts

on how Norton ALUNDUM catalyst carriers are *engineered and prescribed* to give you the most effective combination of physical, thermal, chemical and electrical properties. Learn how they can improve and economize your processing. Call in your Norton Refractories Engineer, or write, mentioning your specific requirements, to NORTON COMPANY, 506 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

NORTON
REFRACTORIES
Engineered... Rx... Prescribed
Making better products... to make your products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



WANT a pipe that can take it? One that will end your corrosion worries? Want a pipe that handles acids, alkalis, alcohols, salts and hundreds of other chemicals with the same impunity with which it transports water?

Then you want USS NATIONAL* PVC Plastic Pipe.

This extruded Polyvinyl Chloride Pipe is available in sizes ½" to 6" diameter—in Schedules 40, 80 and 120. You can get NATIONAL PVC Plastic Pipe in two types:

NORMAL IMPACT—designed for installations requiring the highest chemical resistance attainable, together with high strength and excellent creep resistance.

HIGH IMPACT—designed for installations requiring excellent chemical resistance and a high degree of toughness, even at low temperatures.

In addition to its excellent chemical resistance, NATIONAL PVC Plastic Pipe offers:

Rigidity—permits use in overhead piping installations with pipe supports. Schedules 80 and 120 pipe may be threaded with steel threading dies.

Lightness—twenty feet of 2-inch, Schedule 40 pipe weighs less than 13 pounds. Easy to install in cramped space and hard-to-reach places.

Weather Resistance—resists deterioration due to aging when exposed to direct sunlight. Also resists fungi, bacterial action and soils.

Simple Installation—fittings quickly and easily attached by either solvent cementing, threading, heat welding, or adhesives.

Smooth Internal Surface—results in low flow resistance, minimizes build-up of deposits.

**Trademark*

For further details on USS National Polyvinyl Chloride Plastic Pipe, including a complete list of chemical resistances, send for Bulletin 24. Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

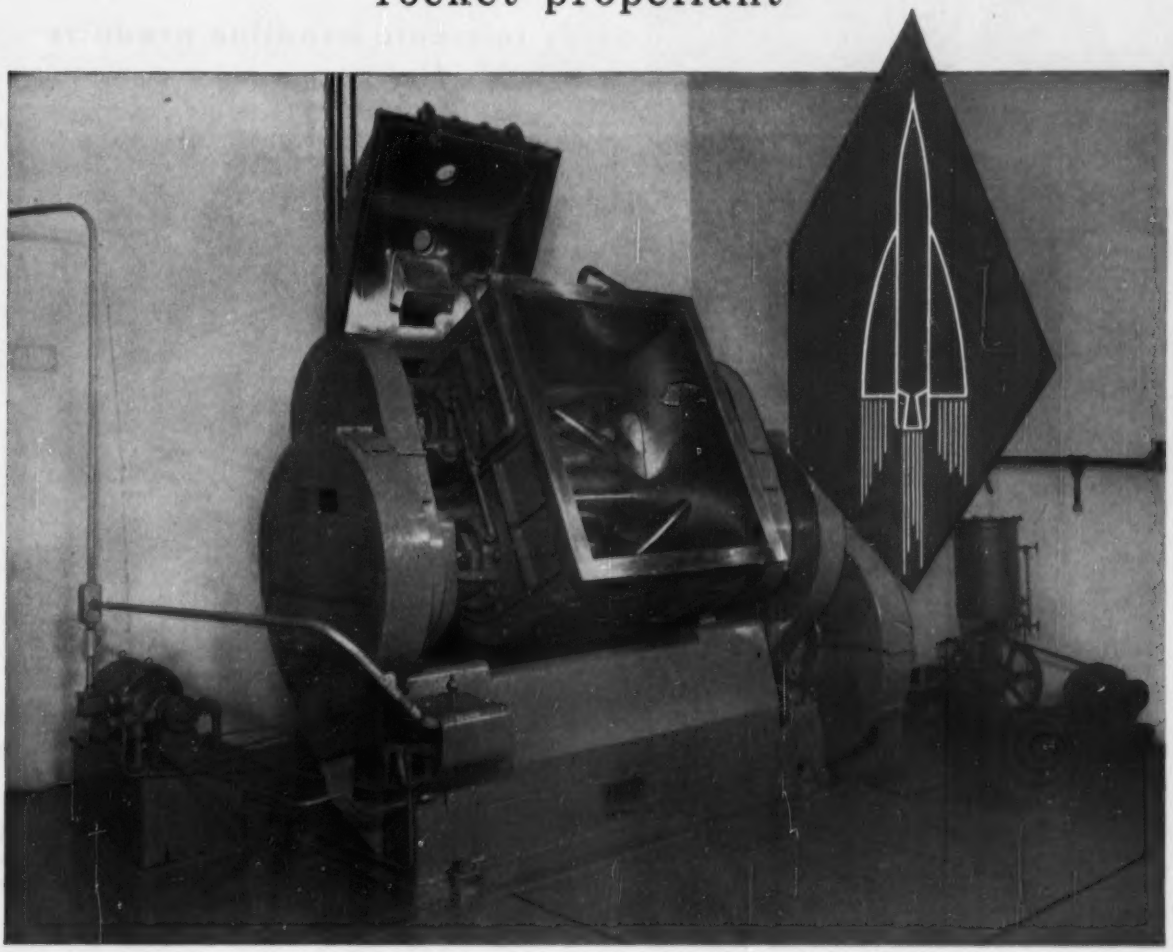
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

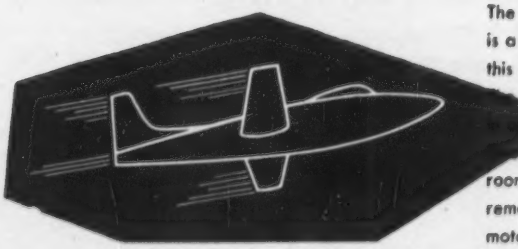
USS

NATIONAL *plastic* PIPE

UNITED STATES STEEL

Thiokol® Chemical Corporation selects BAKER PERKINS mixers for processing rocket propellant





The mixing of rocket propellant from new high-energy fuel materials is a sensitive, highly demanding operation. The mixers which do this blending must therefore be not only efficient, but dependable. The Baker Perkins No. 15 Mixer shown here is but one of many [illegible]tion in the rocket propellant field. This unit at the [illegible]kol Chemical Corporation is enclosed in an explosion-proof room of reinforced concrete, and is engineered for complete remote control operation. Powered by a 50 H.P. silent chain drive motor, the No. 15 Mixer is constructed of Stainless Steel, and jacketed to carry 125 psi pressure of steam or water. Its Sigma blades revolve on anti-friction bearings, hydraulic tilt is provided for the mixing chamber, and the vacuum cover is pedestal mounted. Working capacity of this mixer is 100 gallons, and total capacity 150 gallons. If you have a process that calls for a high-performance mixer, write Baker Perkins for complete catalog.

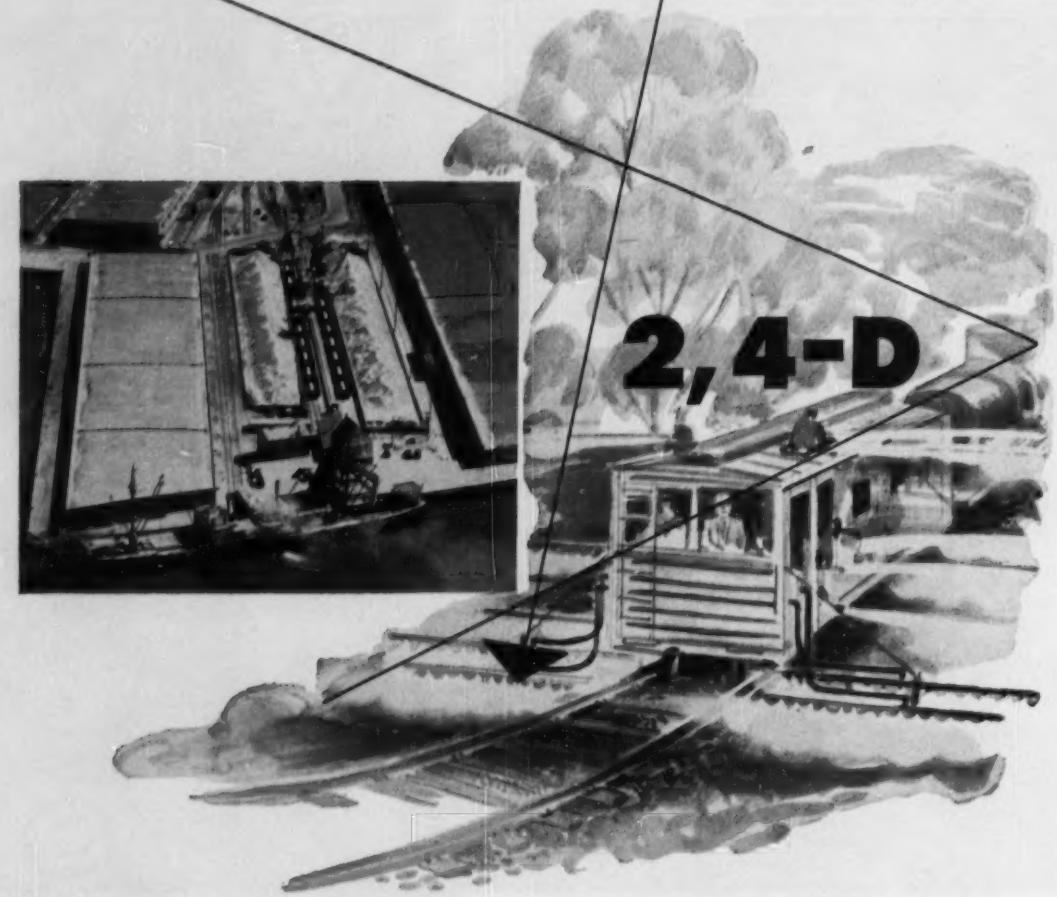
Baker Perkins Inc.

Chemical Machinery Division
Saginaw, Michigan

333

sulphur

helps to create headline products



Naturalists have said that the forests would take over our cities in short order should all human activity cease. Railroads see vivid evidence of this on a small scale. They're constantly battling weeds on rights-of-way, on sidings, on spur lines.

Today, the battle is being fought more successfully than ever before with a new and powerful broadleaf weed killer 2, 4-D. And this chemical is proving useful, too, in suburban areas.

Where does Sulphur fit into the picture? It takes Sulphur to make sulphuric acid. It takes sulphuric acid to make phenol. It takes phenol to make 2, 4-D.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Sulphur Producing Units

- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

Custom Designed

For a Bigger Yield

Higher yield in your case may mean cleaner, dryer cake . . . or better recovery of solubles . . . or just plain fast, trouble-free operation on a job that's got to be done. If you can get a few points better efficiency at no extra cost, why not?

FEinc custom-designed continuous vacuum filters have been doing just this for 37 years: For instance:

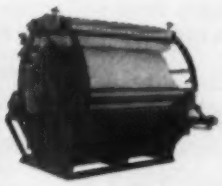
- Replaced six settling tanks in recovering plastic grinding waste . . . paid for itself in 3 months
- Reduced moisture in iron pigment from 68 to 59%
- Cut recycling of difficult gelatinous sulphate cake from nine to five cycles
- Eliminated plugging, gave three hours more running time daily on sticky clay
- Reduced solubles in metallic stearate from 0.5 to 0.05%
- Recovered ⅔ of chromates left by competitive filter

All types of continuous rotary vacuum filters . . . string, horizontal, scraper, precoat, etc. . . . are custom designed and manufactured by FEinc . . . quality built because quality pays you. Ask for bulletins . . . or for recommendations . . . no obligation, of course.

47

For a Bigger Yield **FEinc**

FILTRATION ENGINEERS, INC.
155 Oraton Street, Newark 4, N. J.



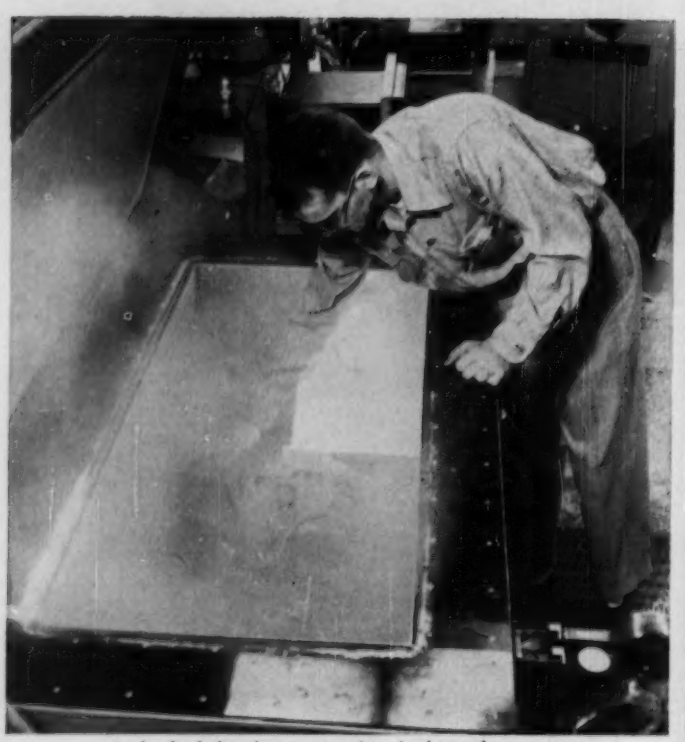
STRING

HORIZONTAL

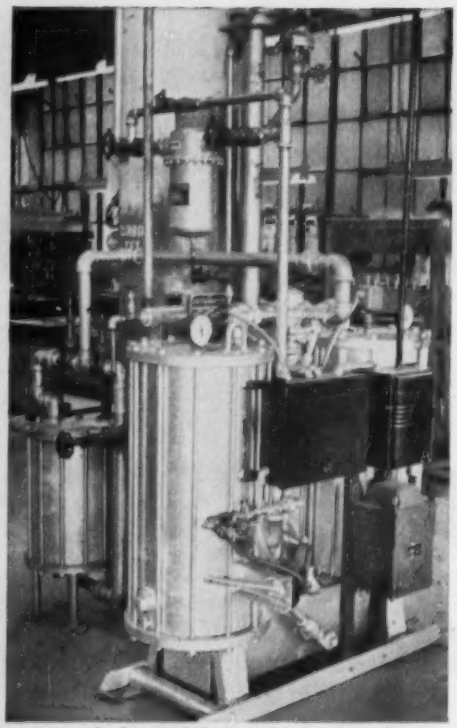
SCRAPER

CUSTOM DESIGNED CONTINUOUS FILTRATION

Thousands of dollars per month saved when DRYair replaced premium-grade nitrogen in testing electronic equipment



A cloud of fog forms as moist air from the room meets the –67° air in the test chamber.



A recent check revealed that this BAC-150 Lectrodryer is delivering air dried to a –70°F. dewpoint.*

ELECTRONICALLY-CONTROLLED pneumatic actuators built by the Electronics Division of Thompson Products, Inc. of Cleveland maintain 400 cycles per second within limits of plus or minus one per cent—classed as "phenomenal accuracy" by men who know. Regulation and testing of this equipment is carried on in cold chambers simulating environmental conditions of altitude and temperature.

Standard bottled nitrogen was used at first to drive these mechanisms, but it quickly froze up as it has a dewpoint of –50°F. Then they went to premium-grade nitrogen having a dewpoint of –70°, but this costs 70 cents per cubic foot and as many as seven bottles of nitrogen were used per unit.

Now they have this Lectrodryer. It takes air from the shop line, cleans and dries it to –70°F. dewpoint, actually saving them thousands of dollars every month. Thus the Lectrodryer pays for itself many times over.

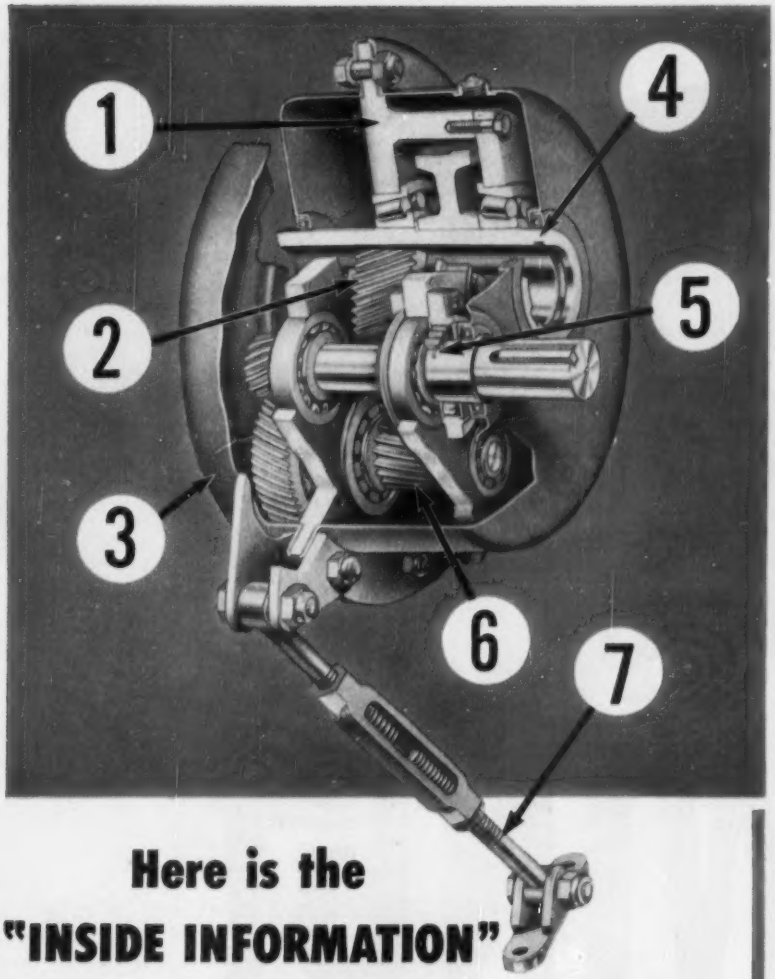
Have you a moisture problem? Write, giving data on it, to Pittsburgh Lectrodryer Company, 303 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S.A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U.S. PAT. OFF.



Here is the "INSIDE INFORMATION" on FALK ALL-STEEL Shaft Mounted Drives

Take a careful look inside the Falk all-steel Shaft Mounted Drive, and you will know why this newest member of the famous Falk family is ideal for applications where direct mounting on the driven shaft is desirable. It is the only drive in its field with all these superior "In-built" factors:—

1 **All-steel Frame,** with more than double the rigidity of iron, supports all rotating elements.

2 **Precision Helical Gears,** designed and machined by Falk, rated to AGMA standards.

3 **Pressed Steel Housings,** whose sole function is to keep oil in, dirt out; easily removed for gear inspection without dismounting unit.

4 **Through Hollow Shaft** with counter bore provides for easiest installation or removal from driven machine shaft extensions.

5 **Backstop** can be furnished with the unit or added later for positive prevention of reverse rotation.

6 **Positive Lubrication,** continuous direct dip of revolving elements at all speeds.

7 **Tie Rod** and turnbuckle serve as anchor and facilitate V-belt or chain adjustment.

Write to Department 247 for engineering bulletin, including selection and dimension details.

EFFICIENT SPEED REDUCTION IN LIMITED SPACE

SIX SIZES

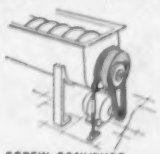
- 1/2 to 30 hp
- Single or double reduction
- Wide output speed range—420 to 10 rpm

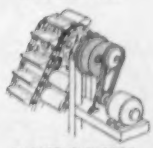
Expressly designed for topflight performance on installations requiring considerable speed reduction in limited space, the all-steel FALK Shaft Mounted Drive has quickly won acceptance throughout industry. This sturdy, compact, versatile reducing unit is an ingenious variation of the highly successful FALK Motoreducer design, pacemaker in its field for more than 20 years. Here, the time-proved design is adapted for mounting directly on the shaft to be driven, using V-belt connection to motor. Investigate now!

A FEW TYPICAL APPLICATIONS

APRON FEEDER

LINE SHAFTING


SCREW CONVEYOR


BUCKET ELEVATOR

BELT CONVEYOR

GRAVEL CLASSIFIER

THE FALK CORPORATION, Milwaukee 8, Wisconsin

MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

FALK

...a good name in industry

FREE FLOWING!

Process Lines of Chase® Copper Water Tube can never clog with rust!

Because process line joints of Chase Copper Water Tube and Solder-Joint Fittings have *no* internal projections, your pumping costs are kept to a minimum. Even heavy industrial fluids flow freely through Chase Copper Water Tube — its clean, smooth interior surface can *never* clog with rust!

Process lines of Chase Copper Water Tube and Solder-Joint Fittings also put an end to costly repairs and maintenance. Once installed, the system stays pressure-tight, trouble-free.

Chase Copper Water Tube comes in long lengths, is easy to install, will give you years of rust-proof service. Find out more—Contact your nearest Chase Wholesaler or Chase warehouse.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper & Stainless Steel

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
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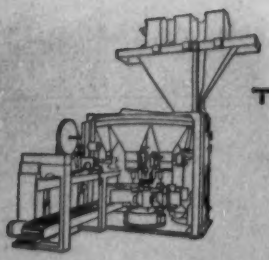
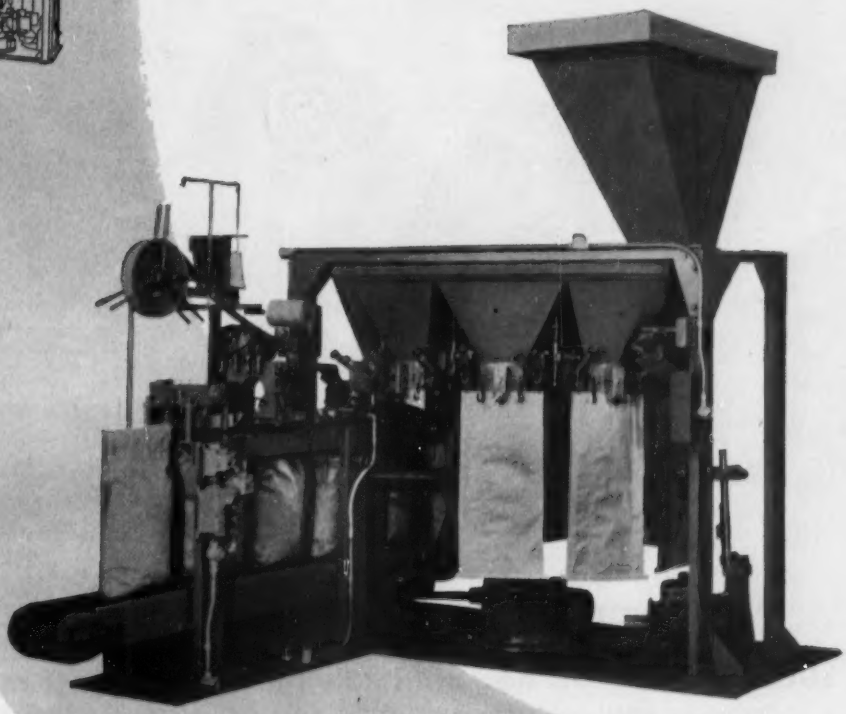
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	



THE BEST FOR TWENTY-FIVE YEARS



Now with improved design...
"THE BAGPAKER"*
IP's NEW, model "AF"

"The BAGPAKER"* Model "A" for 25 years has proved there is no better method than the rotary turret for maintaining a high packing rate. Not one Model "A" Bag Packing Machine installed by us has ever been replaced by another design.

Now this proven machine has been modified and simplified, incorporating all the improvements indicated desirable in 25 years of unrivalled successful operation.

"THE BAGPAKER" NEW MODEL "AF" FEATURES: ● *New Simple Design, for free-flowing or semi-free-flowing feeds, fertilizers, etc.* ● *Simplified Operation and Maintenance* ● *Automatic sewing reduces bag size—cuts cost* ● *Packs from 20 to 25 multiwall bags per minute with one operator* ● *LOWER COST.*

*TRADEMARK

For detailed information, call or write CE-7 - no obligatio

International Paper COMPANY

BAGPAK DIVISION

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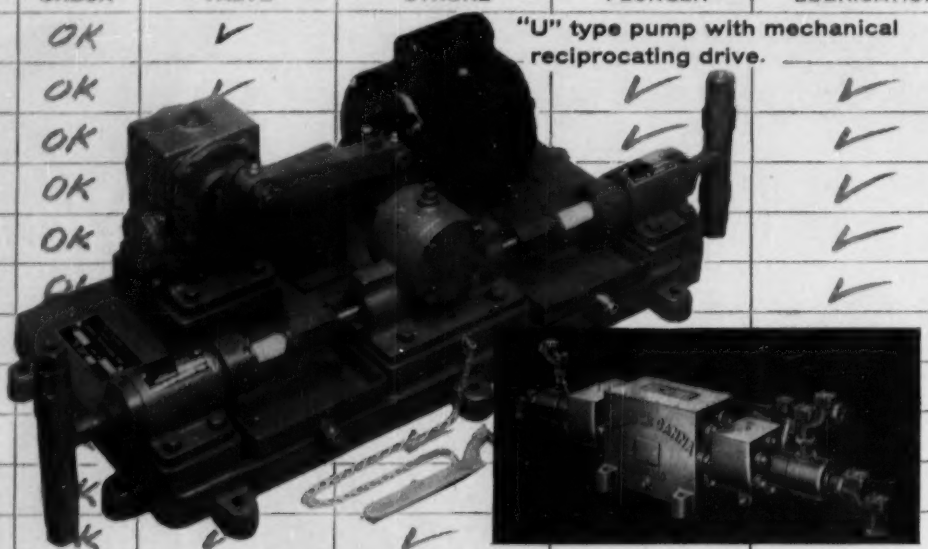
Why the FIRST COST is the LAST COST with HILLS-McCANNA METERING PUMPS

PUMP MAINTENANCE REPORT

MONTH	CHECK	VALVE	STROKE	PLUNGER	LUBRICATION
JANUARY	OK	✓			
FEBRUARY	OK	✓		✓	✓
MARCH	OK			✓	✓
APRIL	OK				✓
MAY	OK				✓
JUNE	OK				✓
JULY					
AUGUST					
SEPTEMBER					
OCTOBER	K				
NOVEMBER	K	✓	✓		
DECEMBER	OK	✓	✓	✓	



"U" type pump with mechanical reciprocating drive.

"K" type pump with hydraulic drive.

HILLS-McCANNA dependability pays off in lower maintenance . . . longer life . . . greater accuracy . . . cost-saving versatility

Maintenance reports from the leaders in many different industries prove the low-cost operation of Hills-McCanna metering and proportioning pumps . . . tell why these pumps are specified for installations requiring the finest equipment. Part replacement is remarkably low because there are few points of wear. Routine maintenance is simple and economical thanks to special Hills-McCanna features, such as separate interchangeable check valves and easy, precise stroke adjustment (even while in operation when desired). Working parts are completely enclosed to keep them dirt-free. All U Type pump bodies are interchangeable in the housing for quick convertibility. Straight reciprocal drive eliminates bushing replacement. And, you'll find Hills-McCanna pumps mighty easy to install.

If you must continuously meter or proportion small volume flows with great accuracy, you'll want to consider the "U" type pump—available in 1, 2, 3 and 4 feed units. The "K" type pump —also available in 1, 2, 3 or 4 feed units—will meet your larger flow requirements.

Hills-McCanna can furnish a pump to meet *every* type of installation . . . with a wide choice of corrosion, wear and abrasion-resistant liquid ends . . . in capacities and pressures for every need.

Write for full facts now. You'll be dollars ahead tomorrow by investigating today!

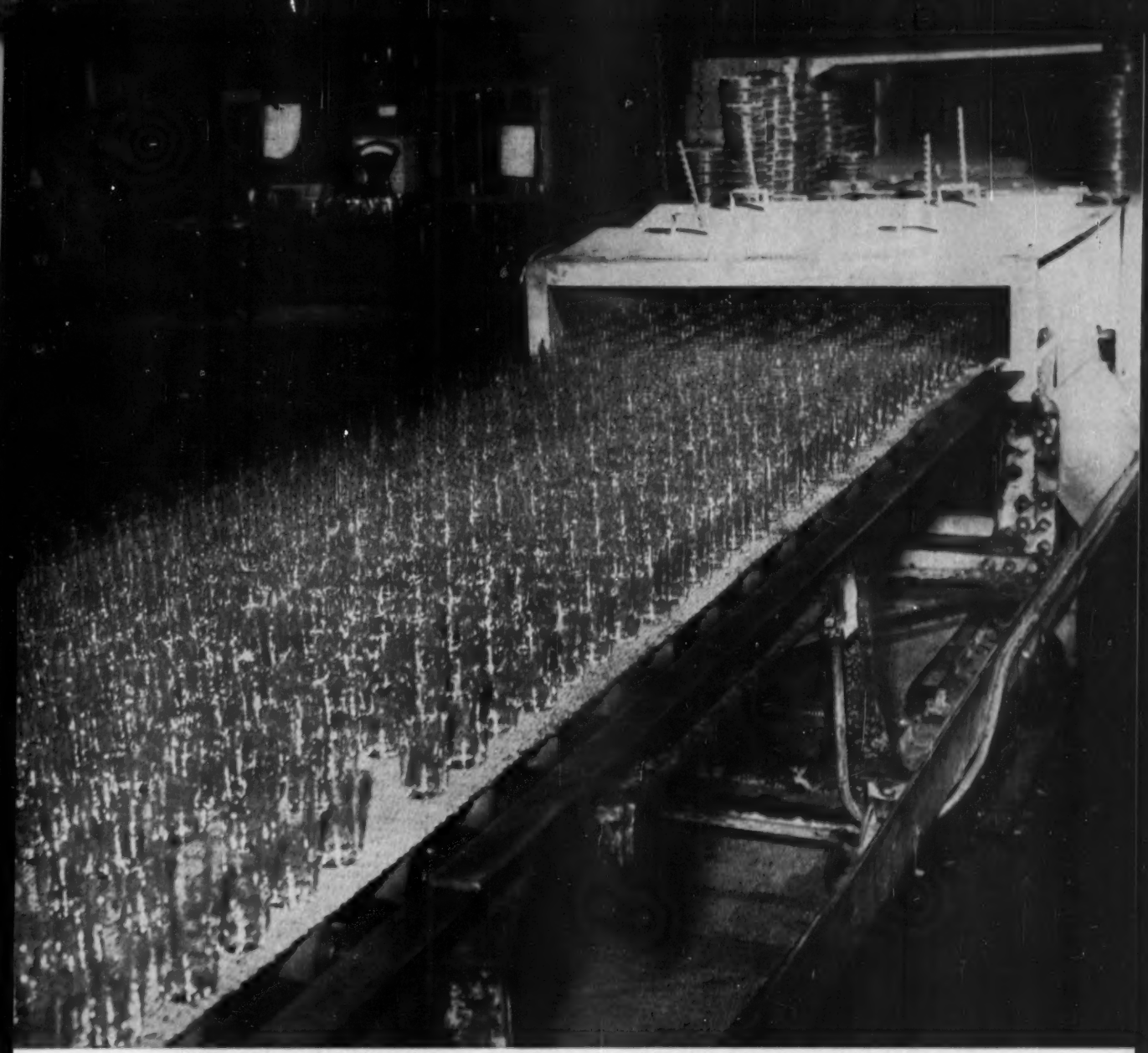
A dependable NEW HEART to put NEW LIFE into your chemical metering system!

HILLS-McCANNA COMPANY

3025 N. Western Avenue, Chicago 18, Illinois

metering and proportioning pumps

also manufacturers of: FORCE FEED LUBRICATORS • DIAPHRAGM VALVES
MAGNESIUM ALLOY SAND CASTINGS



Wissco Belts carry Libbey glassware through annealing lehr. The glassware—and the belts—are subjected to elevated temperatures for approximately an hour. This is another example of how...

FAMOUS NAMES

ride on WISSCO BELTS

Libbey Glass Division of Owens-Illinois

Libbey is a name that's well known for glassware of top quality. For its annealing operation, which helps insure this quality, Libbey purchased four Wissco Belts of thin, flat construction with improved lehr edge. High heat is applied at the beginning of the operation, and then gradually diminished. The glassware emerges at the cool end of the lehr with stresses and strains equalized. Wissco Alloy Processing Belts are the choice of many famous names in industry—leaders in their fields. You, too, will find Wissco the most economical and efficient belt for every processing operation—for metals, ceramics, glass annealing and decorating.

For details, *write or call our nearest office:*

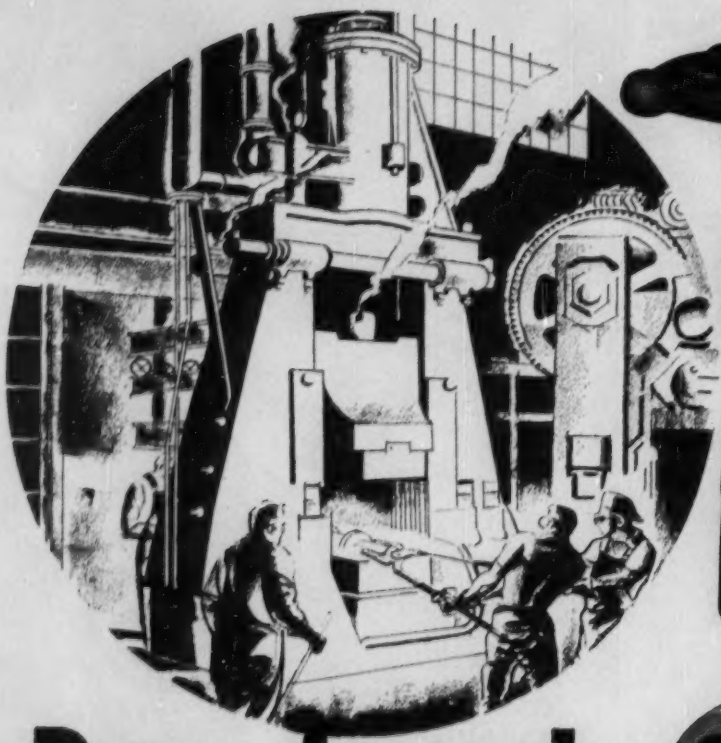
THE COLORADO FUEL AND IRON CORPORATION
Denver and Oakland

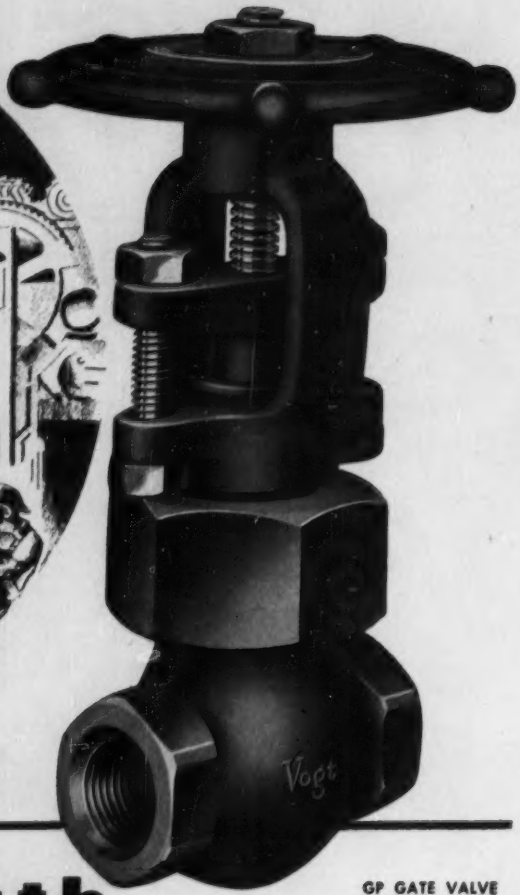
WICKWIRE SPENCER STEEL DIVISION
Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans
New York • Philadelphia

WISSCO BELTS
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

CF&I

2769





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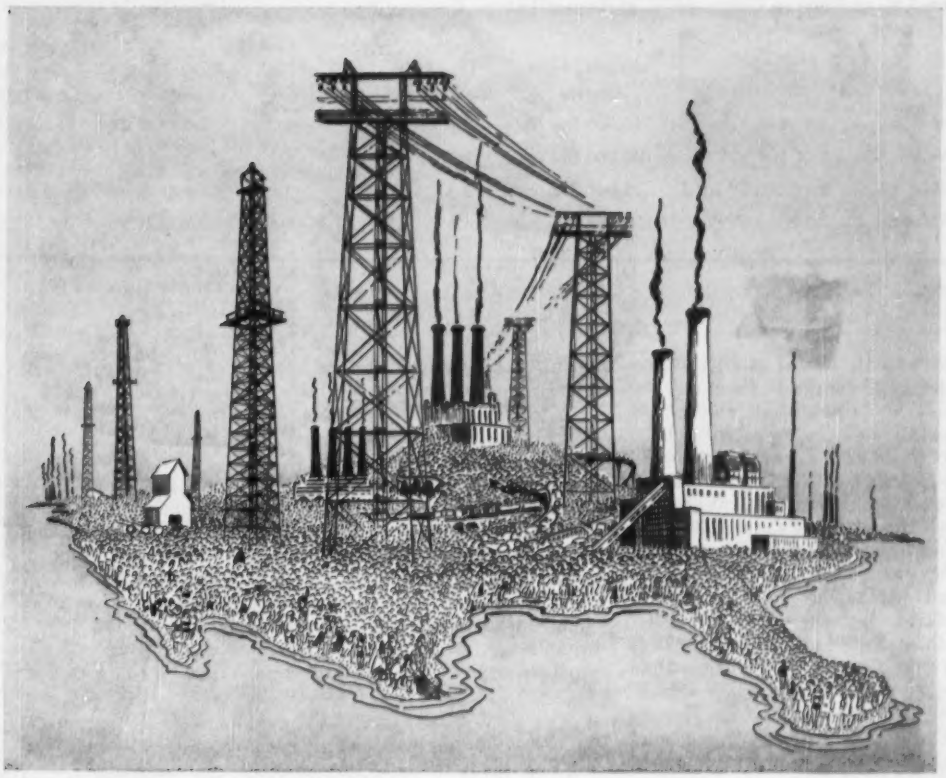


Looking ahead—we face mounting population and growing per capita demand for energy, a two-fold energy drain.

Energy Resources—How Thin?

RUSSELL G. DRESSLER and ROBERT R. CRUSE, Southwest Research Institute*

Present population of the United States is estimated at 160 million people and is predicted to hit 200 million within the 44-year span to 2000 A. D.

By itself, this 25% jump in the number of energy consumers will swell the torrent of energy being drained from nature's storehouses. Projected against a per-capita energy consumption that has soared from 48 million Btu. in 1940 to 70 million Btu. in 1953, it is downright breathtaking. And all signs point to still further growth in the per-capita appetite for energy.

Little wonder then that the industrial fiber of our nation has tensed to the challenge and is pushing development of energy sources and utilization. Information flashing across the pages of the daily press reports how frontiers are moving forward in utilization of nuclear, solar and cosmic energy.

Right now, though, our prime concern is with conventional sources of energy. What is their present status and how do they relate to the newer sources of energy? Just how critical is supply of energy from present sources?

Forms of Energy

Most useful energy as we know it today is chemical energy contained in coal, oil shale, petroleum and natural gas. To a

* Meet your authors on page 344.

From 1% of Reserve Comes 68% of Present Energy Consumption

Source	Total Reserves	Average Heat Content	Total Heat Content, Btu.	% of Total Reserve	Annual Rate of Consumption, Btu.	% of Total Annual Energy Consumption	Reserve Life, Years
Coal	1.9×10^{12} tons	10,000 Btu./lb.	3.8×10^{19}	93.9	9.3×10^{15}	32.0	4,000
Shale oil	5×10^{11} bbl.	100,000 Btu./gal.	2.1×10^{18}	5.2	.....	.....	.....
Natural gas	2.14×10^{14} cu. ft.	1,000 Btu./cu. ft.	2.14×10^{17}	0.5	9.4×10^{15}	32.3	22.8
Petroleum	3.69×10^{10} bbl.	100,000 Btu./gal.	1.68×10^{17}	0.4	10.38×10^{15}	35.7	14.9

lesser extent, useful energy exists as biological energy in food, and the kinetic and potential energy of waterfalls and rivers, see p. 176.

To improve our supply of useful energy calls for extension of proven reserves and more efficient utilization of the available supply. We shall highlight supply as we discuss each energy source in turn. More efficient utilization of fuels is exemplified by the modern boiler which at 2,000 psi. and 1,000 F. is considerably more efficient than older types operating at 450 F. Likewise, the latest turbine designs utilize available energy much more completely than reciprocating steam engines.

Coal and Lignite

Despite the turmoil that has characterized the coal industry in recent years, coal remains our largest reserve of fossil-type fuels.

Our coal and lignite reserves amount to about 1.9 trillion tons according to one source,[9] and 2.5 trillion tons according to a second source.[10] Our annual usage in 1953 was 465 million tons or 32% of the fossil energy consumed annually. At this rate of consumption, our total coal reserves based on the 1.9-trillion-ton estimate would last about 4,000 years.

The U. S. Bureau of Mines, in a more cautious estimate, has placed the life of U. S. coal reserves at 1,700 years.[9] Part of this more conservative estimate is justified because no complete coal survey has been made in the U. S. within recent years.

Some doubt exists as to the extent of the coal reserves that can be mined economically. For example, in Cambria County, Pa., it has been estimated that less than half of the coking coal in seams 28 in. or more thick can be recovered by present mining methods.

In addition to its fuel use, coal is an important raw material reserve for the chemical industry. Although consumption of coal for chemicals is very small at present, it may become quite large because known reserves of petroleum and natural gas are small by comparison. The gasification of coal for chemical purposes is being studied by at least 20 major oil, chemical, pipeline and engineering firms.

Petroleum

To a large extent our present economy is based on the internal combustion engine which utilizes liquid fuels. For this reason, petroleum and other liquid fuels loom large when we consider our future energy sources.

Optimists and pessimists have conducted a running argument regarding the life of our reserves. So far, the United States has been fortunate to continually discover new fields and develop increasingly efficient recovery and refining processes to offset increased demand. However, we are producing 50% of the world's oil from less than 25% of the proved reserves.

Crude oil and lease condensate production and reserves are shown on the opposite page.

The projected demand for petroleum products in 1975 is twice the 1950 consumption and six times the figure for 1925. Proven U. S. petroleum and lease condensate reserves were 36.9 billion bbl. in 1955, production was 2.47 billion bbl. At this rate petroleum represented 35.7% of fossil energy consumed.

Ratio of reserves to production as of the beginning of 1956 indicates an index of 14.9 years for our petroleum resources. In 1949 the index was 15.4 years. This indicates that presently we are maintaining our reserves, with perhaps a slight decline.

The number of years total supply of petroleum is difficult to calculate because future discoveries are involved. The outlook in recent years has been optimistic because oil discoveries have kept pace with depletion.

When the time comes that discovery of new deposits definitely declines, we can predict our petroleum life span accurately by projecting our discovery and usage rates and allowing for known reserves at that time. This time has not come, yet it has been estimated that it is not too far distant, within 10 years or so.

Secondary recovery, imports of petroleum, synthesis of fuels by the Fischer-Tropsch process and coal hydrogenation all will help future supplies of liquid fuels. See the graphic comparison between crude oil discovery and production in the southwestern United States.

Shale Oil

One bright glow on the horizon of petroleum reserves is the prospect of shale oil recovery. Proven reserves are 500 billion bbl. of liquid fuels, distributed over some 2 million acres of Colorado, Utah and Wyoming. Progress on the recovery processes has gone sufficiently far that the U. S. Bureau of Mines closed down its shale oil pilot plant at Rifle, Colo., last year.

In addition to the liquid fuels, coke, sulfur and ammonia will be obtained as byproducts as well as some hydrocarbon gas. It is generally accepted that gasoline from shale oil will cost only a few cents per gallon more than from petroleum.[9]

Natural Gas

So far, actual reserves of natural gas have held constant. The ratio of reserves to production, however, indicates that this index has dropped from 25.4 years in 1950 to 22.8 years in 1955. We are producing the largest single share of the world's gas from reserves which possibly may already have been largely proven, and which may not offer vast expansion. Present reserves are 214 trillion cu. ft.

Natural gas is now available to nearly all sections of the U. S. through local or long-distance pipelines. It is a convenient source of heat. In addition, it is used increasingly for manufacturing ammonia, methanol, acetylene and other chemicals.

Together, these two outlets continue to boost demand on natural gas production and reserves. Natural gas production and reserves are shown graphically also.

Nuclear Energy

The role of atomic and nuclear energy is still in a period of transition.[6] Production and reserve figures of uranium and thorium are classified, although it has been stated that mine production of uranium ore has doubled in every 18-month period since 1950.

Lately, lithium has been considered in the realm of fuel reserves for nuclear energy. Practically all the information about lithium in this field has been classified to date, however.

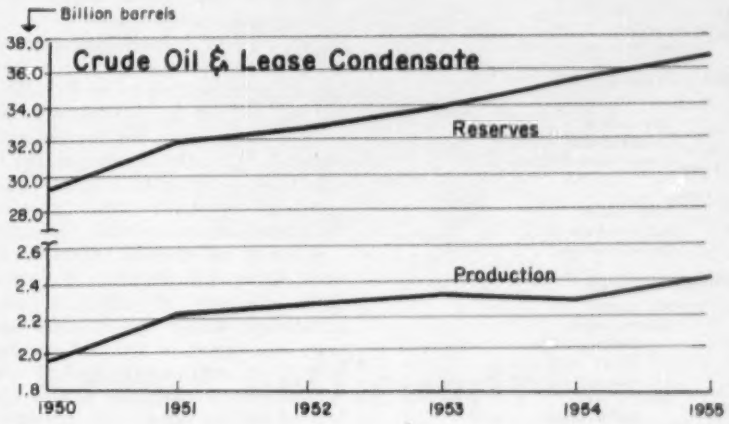
Accurate prediction of the use of nuclear energy in the near future is difficult because we are now at a critical stage in the development. However, nuclear reactors to be constructed for generating power now total over 900,000 kw. Included are reactors for Consolidated Edison, Consumers Public Power District, Detroit Edison Group, Nuclear Power Group, Pennsylvania Power and Light, Rural Cooperative Power Associates, Yankee Atomic Electric Co., and U. S. Atomic Energy Commission.

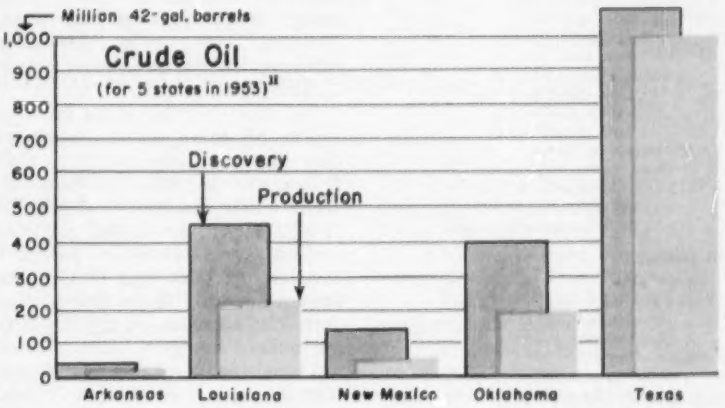
It is estimated that by the year 2,000 nuclear energy will contribute to the U. S. energy system a maximum potential of 15 x 10^{15} Btu. annually, distributed 60% to work, 10% to process heat and 30% to comfort heat.[1] For comparison, energy derived from coal is presently 1 x 10^{15} Btu. annually, or roughly 6.7% of nuclear energy potential 44 years from now.

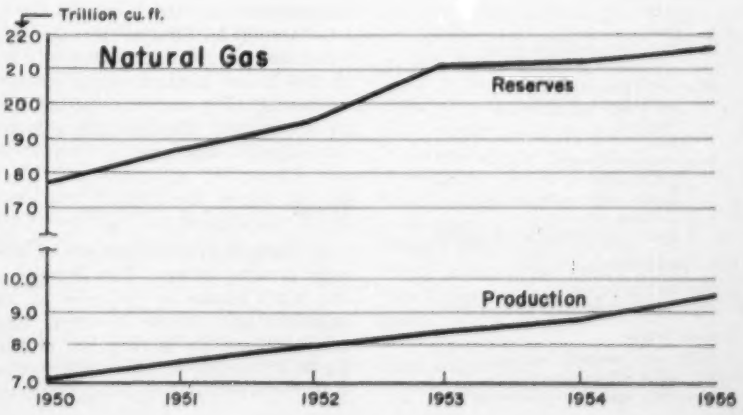
Solar Energy

All of our energy, directly or indirectly, has come or will come from the sun. The indirect methods such as wood and fossil fuels obviously require long periods of time for conversion.

Much recent effort has been made to convert sunlight, or other solar-initiated phenomena, directly into







Major Forms of Energy

• • • • Present major source
• • • Present minor source
• • Future major source
• Possible future source

Chemical Energy

Fuels
• • • • Solid—oil shale, coal
• • • • Liquid—petroleum
• • • • Gas—natural gas
Explosives—not of natural origin
Electrolytic elements—synthetic

Biological Energy

Foods
• • • Fats—animal
• • • Carbohydrates—sugar
• • • Protein—lean meat

Fuels
• • • Solid—wood
Liquid—whale oil
Gas—marsh gas

Mechanical Energy

Potential energy
Elevated mass
Solid—glaciers
Liquid—rain
Gas—atmospheric pressure
Stressed mass
• • • Solid—stresses in earth
• • • Liquid—oil well pressure
Gas—gas reservoir pressure

Kinetic energy
Linear motion of mass
Solid—glaciers
• Liquid—tidal energy
• Gas—wind
Angular motion of mass
Solid—rotation of earth
• Liquid—tidal energy
Gas—tornado winds

Mechanical wave motion
Three-dimensional waves
Solid—seismic disturbance
Liquid—marine sounds
Gas—atmospheric sounds

Thermal Energy

Heated mass
• Solid—earth heat
• Liquid—sea water heat
Gas—volcanic steam

Energy of state
Solid—gamma phase of iron
Liquid—lake and ocean water
Gas—earth atmosphere

Electromagnetic Energy

Electric fields
Solid
Liquid
Gas—atmosphere to earth electrical potential

Magnetic fields
Solid—geomagnetism
Liquid
Gas

Electromagnetic waves
• Solid—chirps
Liquid—solar radiation in bodies of water
• Gas—solar energy in atmosphere

Free Particle Energy

• Mesons—cosmic rays
• Ions—ionospheres

Nuclear Energy

Radioactive materials—radium
• •Fissionable materials—U 235
• •Fusionable materials—deuterium

usable energy. Conversion methods include direct concentration of sunlight by means of mirrors or lenses;[7] photoelectric cells; photosynthesis collectors or converters such as cultures of algae or plants; "greenhouse" stills and black surface collectors; temperature differentials in both polar and tropic waters, and phosphorus.

The over-all average radiation of solar energy in the United States has been calculated to be 430 Btu. per sq. ft. per hr.[8] Assuming an area of 3 million sq. mi. for the continental U. S., the maximum available energy would be 1×10^{20} Btu. annually, or 3,440 times greater than our present consumption rate.

By way of specific example, an area 52 sq. mi. in size, assuming 50% efficiency of collection and utilization, would supply solar energy equivalent to 10% of our entire U. S. coal production of 465 million short tons. The dual problem of having 52 sq. mi. available and collecting efficiently the energy that falls upon them is a major problem. However, the recent solar-energy conferences in Tucson and Phoenix, Ariz., show that these problems will not be allowed to exist unchallenged.

The most feasible areas for utilization of solar energy—Arizona, New Mexico, Texas, southern California and southern Nevada—are areas where the energy demand is fairly small. Industrial activities are not very numerous, except in the Los Angeles and Texas Gulf areas, nor are there many other activities which would require large amounts of energy.

These considerations do not mean that the future utilization of solar energy will be neither feasible nor attempted in other areas. Solar-heated houses in Massachusetts and Illinois indicate the potential.

It would be difficult to say just what the role of solar energy will be in the future picture of our energy resources. We can say positively, however, that this source will be investigated further.

Wind

A further possible source of energy is wind power. The energy in the wind varies as the cube of its velocity, but under 18 mph. the available energy is very low or nil. To be attractive economically in the U. S., a wind system must have an annual velocity of at least 28 mph. at the hub of the fan.

An experimental 1,250 kw. turbine was built on Grandpa's Knob, Vt., in 1940. After experimenting for five years with this installation, the engineers concluded that the major mechanical problems had been solved.[1] Complete commercial design information was obtained.

Plausible estimates of the annual contribution of wind power to the U. S. energy system within the next 100 years are of the order of 1×10^{18} Btu. which is exactly equal to our present coal consumption.[1]

Hydroelectric Power

Hydroelectric power is an inexhaustible energy source. In 1955, the U. S. had 21 million installed kw. generating 112 billion kwh. Forty percent of the total is owned and operated by the government. For comparison, the figure of 112 billion kwh. is equivalent to about 4% of the energy we derive from coal annually. Hydroelectric power will continue to be a supplement to our reserve energy.

Energy Source Comparison

Our four principal expendible energy reserves are coal (93.9% of the total), shale oil (5.2%), natural gas (0.5%), and petroleum (0.4%). These are shown in the comparative table top of p. 174. When interpreting these reserves, consideration must be given in each case to important relative factors such as cost on a Btu. basis and state of the art in the production and utilization of each type of energy reserve.

(This article is based on paper from Third Annual Joint Technical Meeting, AIChE and ACS, Beaumont, Tex., Mar. 9, 1956.)

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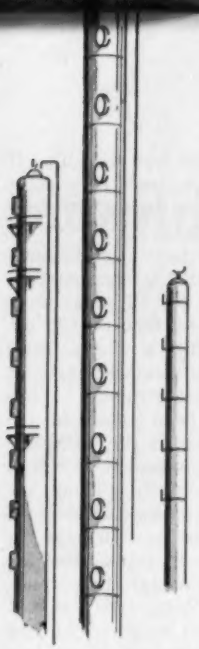
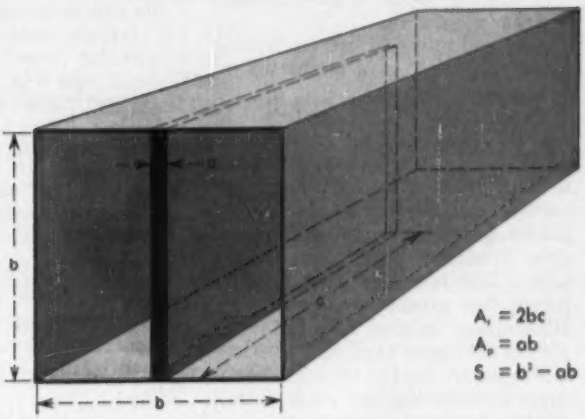


100 mph.

What is the wind load on the tower?

What is the pressure drop in a strut-type entrainment separator?



Why Not Use Drag Coefficient?

For a better understanding of certain problems in fluid flow and to help you solve them faster, more accurately, the drag-coefficient approach may be just the thing you've been looking for. Try it.

W. R. GAMBILL, Carbide & Carbon Chemicals Co., Charleston, W. Va.*

CHEMICAL engineers have long used so-called Fanning or Darcy equation friction factors for calculating frictional pressure losses incurred by fluids flowing through conduits. Meanwhile, aeronautical and marine engineers have been using a variable which they term the drag coefficient, and usually denote by the symbol C_D. This term is used for calculating drag forces either on static bodies immersed in flowing fluids or on moving bodies immersed in either stationary or moving fluids.

While equations that involve a drag coefficient term have seen occasional use in the chemical process industries for computing, for example, wind loadings on tall stacks or process vessels, they have been somewhat neglected by chemical engineers in equipment design calculations.

WHERE YOU CAN USE IT

The drag coefficient is quite useful for estimating pressure losses caused by flow through conduits in which are located bodies such as cylinders, spheres, disks and flat plates. A plate- or strut-type entrainment separator is a good example of this equipment.

Although standard drag-coefficient curves (C_D vs. N_{Re} for various shapes) are available[2] for single bodies and unbounded flow, the curves can also be used for bounded flow and/or an assemblage of bodies —so long as there is no interference of boundary layers. You can estimate the thickness of these boundary layers from correlations found in sources such as Eckert[1] and Knudsen & Katz.[3] Knowing the thicknesses, you can predict whether the layers touch as the fluid flows through the equipment.

If the layers do *not* touch, you can use single-body values of the drag coefficient in your design equations.

THREE AREA TERMS

A point which might be confusing to the engineer who tries to relate the unfamiliar drag coefficient with the more familiar friction factor is the area term. In evaluating the drag coefficient there are three areas involved:

- Free flow area normal to the direction of fluid flow, S.
- Tangential or surface area of the immersed body, A_t.
- Projected frontal area of the immersed body, A_p.

For flow through pipes and parallel to flat plates we generally use the tangential or surface area, A_t. However, for flow over spheres, cylinders, disks and various bodies of revolution we usually use the projected frontal area, A_p. The engineer must be sure that he uses the correct area term in the particular drag-coefficient plot or equation that he is working with.

We have mentioned above that the drag coefficient for a given shape is a function of the Reynolds number alone. However, this is only true when motion is steady-state and when there is no distortion or oscillation of the immersed body. Various parametric corrections have been developed for those cases where these two restrictions are not

* Meet your author on p. 346.

met. Correlated coefficients are available for following general cases:

- Liquid drops in gas streams, as from atomizers.
- Liquid drops in other liquids when subjected to accelerative or decelerative forces.

The correlated drag coefficient is nearly always given as a total value, part of which is attributable to skin friction and with the remainder arising from the form or profile drag. In laminar flow the skin friction contribution dominates. The reverse is true for turbulent flow except in cases of very streamlined bodies or of incompletely developed trailing wakes.

Proportioning the total measured drag between the two contributing sources has been accomplished only in isolated instances. Further work along this line is very desirable. An analogy between skin friction and heat transfer is now being used for analyzing flow through tubes. Conceivably we may be able—at some time—to extend this analogy to cases where flow is over various immersed shapes, where the form component of the total drag apparently has little effect on the heat transfer rate.

RELATION TO FRICTION

Now, how are drag coefficients related to friction factors? By definition, the general relationship for friction factor is:

$$f/2 = \Delta P S g/\rho u^2 A_t \qquad (1)$$

If we represent ΔP, the frictional pressure loss per unit cross-sectional area, by R', then:

$$f = 2R'Sg/\rho u^2 A_t \qquad (2)$$

We can show the validity of Eq. (1) for the case of flow through a circular pipe by substituting $G = \rho u$ and $S/A_t = D/4L$ in the following form of the Fanning equation:

$$\Delta P = 2fG^2L/g\rho D \qquad (3)$$

We get Eq. (1) as our result.

The drag coefficient, C_D, is defined as follows:

$$F_D = C_D A \rho u^2/2g \qquad (4)$$

If C_D is based on the tangential area of the immersed body, A_t, and if the frictional resistance per unit tangential area is represented by R, then:

$$C_D = 2Rg/\rho u^2 \qquad (5)$$

Since R evidently equals $R'S/A_t$, we can combine Eqs. (2) and (5) to

$$C_D = f \qquad (6)$$

If, on the other hand, we base C_D on the projected frontal area of the immersed body, A_p, and if we denote the frictional resistance per unit of projected frontal area, F_D/A_p, by the symbol R'', then:

$$C_D = 2R''g/\rho u^2 \qquad (7)$$

Since R'' evidently equals $R'S/A_p$, we may combine Eqs. (2) and (7) to give:

$$C_D = fA_t/A_p \qquad (8)$$

Therefore, Eqs. (6) and (8) show the relationship between the Fanning friction factor and two drag coefficients based on the area terms A_t and A_p.

Now then, what is the simplest method for calculating the pressure drop incurred by a fluid flowing through a conduit or past an immersed particle or body?

If we have available a value for the drag coefficient we can use this simple equation:

$$\Delta P = F_D/S \qquad (9)$$

It is a simple matter to show that Eq. (9) is valid for C_D based on either A_t or A_p. Therefore, the steps in our calculation are these:

- Calculate the drag force, F_D, using Eq. (4).
- Divide the drag force by free cross-sectional area, S, and get the pressure drop in units that are consistent with those used for F_D and S.

SAMPLE PROBLEM

Here's a sample problem using the drag-coefficient approach for its solution. Consider how difficult—if not impossible—it would be to solve this same problem using the friction-factor approach.

Problem—A square duct measuring 14-in. on a side is transporting dry air at 100 F., 10 psig. at a volumetric rate of flow of 120 cu. ft./sec. Following a sharp bend and prior to an instrument installation, smooth straightening vanes 8-ft. long have been placed in the duct. These vanes fit the walls and are spaced 2-in. apart both vertically and horizontally. Thus, the vanes form 49 squares each 2-in. on a side. The vanes are 16 gage, or approximately $\frac{1}{16}$-in. thick. Find the pressure drop through this vaned section.

Solution—First we'll find the free cross-sectional area, S. Then, we find the velocity of the fluid.

$$S = (14)(14) - (12)(1/16)(14) + (18)(1/16)(1/16)$$
$$S = 185.6 \text{ sq. in.} = 1.289 \text{ sq. ft.}$$
$$u = 120/1.289 = 93.2 \text{ ft./sec.}$$

For our area we take the total tangential area of the immersed vanes.

$$A_t = (49)(8)(8)(12)/144$$
$$A_t = 261.5 \text{ sq. ft.}$$

The density of the air is 0.112 lb./cu. ft.; viscosity is (0.000672) (0.0188) lb./ft. sec. We take the length of the vaned section as 8 ft. and evaluate

$$(N_{Re})_x = 6{,}661{,}000$$

In "Fluid Mechanics" by Streeter[4] we are given values of the drag coefficient. For a value of $(N_{Re})_x$ between 10^6 and 10^9,

$$C_D = 0.455/[\log (N_{Re})_x]^{2.58}$$
$$C_D = 0.00316$$

Next we evaluate the drag force.

$$2F_D = (0.00316)(261.5)(0.112)(93.2)^2$$
$$F_D = 402 \text{ lb.}$$

And finally,

$$\Delta P = 402/185.6 = 2.17 \text{ psi.}$$

This gives us the numerical solution to our problem and warns us that the drag force is rather considerable. We must provide a restraining force on the vanes to hold them.

Nomenclature

A_t	Tangential area, sq. ft.
A_p	Projected frontal area, sq. ft.
C_D	Drag coefficient, dimensionless
D	Inside pipe dia., ft.
F_D	Drag force, lb.
f	Friction factor, dimensionless
g	Gravitational constant
G	Mass velocity, lb./hr.-sq. ft.
L	Pipe length, ft.
N_{Re}	Reynolds number, dimensionless
$(N_{Re})_x$	Reynolds number based on length x, dimensionless
ΔP	Pressure drop, lb./sq. ft.
R	F_D/A_t, lb./sq. ft.
R'	ΔP, lb./sq. ft.
R''	F_D/A_p, lb./sq. ft.
S	Free flow area, sq. ft.
u	Linear velocity, ft./hr.
x	Length parallel to flow, ft.
μ	Absolute viscosity, used only in evaluating $(N_{Re})_x$
ρ	Density, lb./cu. ft.

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Simplified Combustion Calculations

Charts cut time for figuring heat and material balances. They are readily applied to any pure hydrocarbon fuel.

1 Heat balance—temperature rise and excess air consumption ..... p. 180
2 Weight per pound of fuel and molecular weight of combustion products 181
3 Methane—weight percent of combustion products 182
4 Gasoline and kerosene—weight percent of combustion products 183
5 Diesel and fuel oil—weight percent of combustion products 184

DANIEL KIST and ROBERT FRUMERMAN, Elliott Co., Jeannette, Pa.

Because combustion problems involving heat and material balances are often tedious, charts have been prepared to simplify the solution of these problems where the fuel is natural gas, fuel oil, or kerosene.

The charts are based on the following simplifying assumptions:

- Complete combustion
- Pure hydrocarbons
- 80 F. fuel
- Dry air (79% nitrogen, 21% oxygen)

Because of the uncertainty of specific heat data at elevated temperatures, the specific heat at the mean temperature was used for all calculations.

Although prepared for three specific fuels, the form of the charts is readily applied to any pure hydrocarbon fuel. Chart 1, the heat balance, may be extended to other fuels by drawing in the appropriate straight line for the new hydrogen to carbon (H/C) weight ratio. The other charts may be extended similarly although all the relationships are not straight lines.

Use of the charts is illustrated by the following examples. Lines drawn on charts show how solutions were made.

Example 1

Find: composition, temperature, and molecular weight of combustion products.

Given: Natural gas, net heating value (NHV) 21,000 Btu./lb. burned with 50% excess air. Temperature of air at burner —500 F.

Enter Chart I at $NHV = 21{,}000$ and move up to the line representing H/C = 0.333. Move right to the 50% excess air line, then up to the line representing $T_1 = 500$ F. Finally, move to right to read $\Delta T = 2{,}390$. Exit temperature is then obtained:

$T_e = 500 + 2{,}390 = 2{,}890$

Composition is obtained from Chart 3. Percent by weight of oxygen, carbon dioxide, and water are obtained from the left-hand scale; nitrogen from the right-hand scale.

$O_2 = 7.55\%$
$CO_2 = 10.20\%$
$H_2O = 8.40\%$
$N_2 = 73.85\%$

Read the molecular weight from the right-hand side of Chart 2.

M.W. = 28.00 lb./mole

Example 2

Find: Air-fuel ratio required to produce a temperature rise of 1,000 F., molecular weight of the resulting products of combustion.

Given: Fuel oil, net heating value 18,400 Btu./lb. Temperature of air supplied to burner—80 F.

Enter Chart I at $\Delta T = 1{,}000$ F. and draw a horizontal line.

From the intersection of this line with $T_1 = 80$, draw a line down to the bottom of the chart. Enter the chart again at $NHV = 18{,}400$ and move up to H/C = 0.15. A line drawn to the right from this point of intersection crosses the vertical line previously drawn at the correct value of excess air. By interpolation:

Excess air = 400%

Weight of products per lb. of fuel is found from Chart 2.

$Wg = 73.2$ lb. products/lb. fuel

Air-fuel ratio is found from:

$A/F = Wg - 1 = 72.2$ lb. air/lb. fuel

Molecular weight is taken from the same chart:

MW = 28.83 lb./mole

Example 3

Find: Firing rate in lb. oil/sec. required to produce 25 lb./sec. of gas at 1,350 F.

Given: Fuel oil, net heating value 18,000 Btu./lb. Temperature of combustion air at burner—500 F.

Proceed by the method of Example 2 to find the percent excess air from Chart 1.

Excess air = 410%

Find the weight of products per lb. of fuel from Chart 2.

$Wg = 74.6$ lb. products/lb. fuel

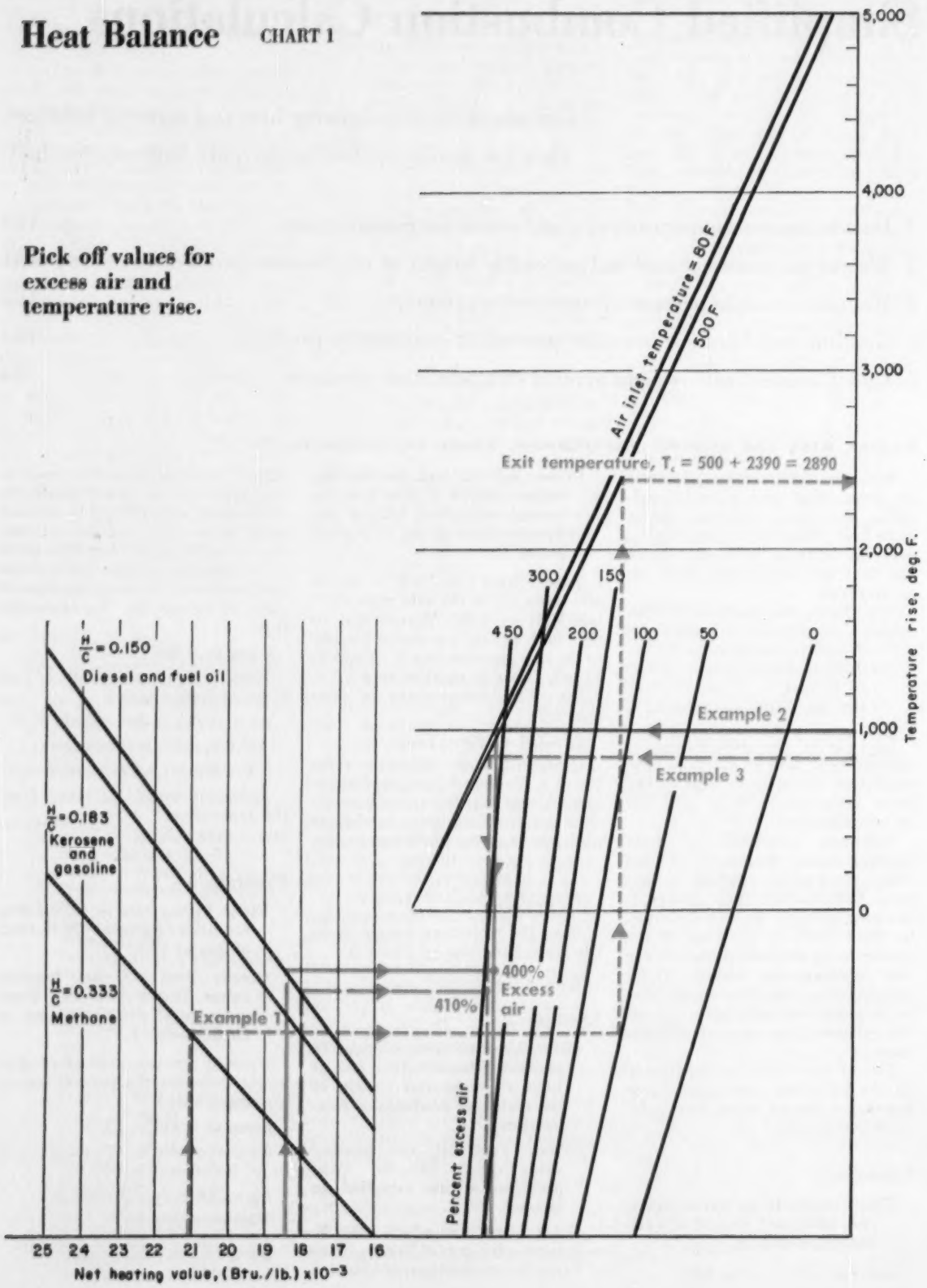
Fuel rate then is:

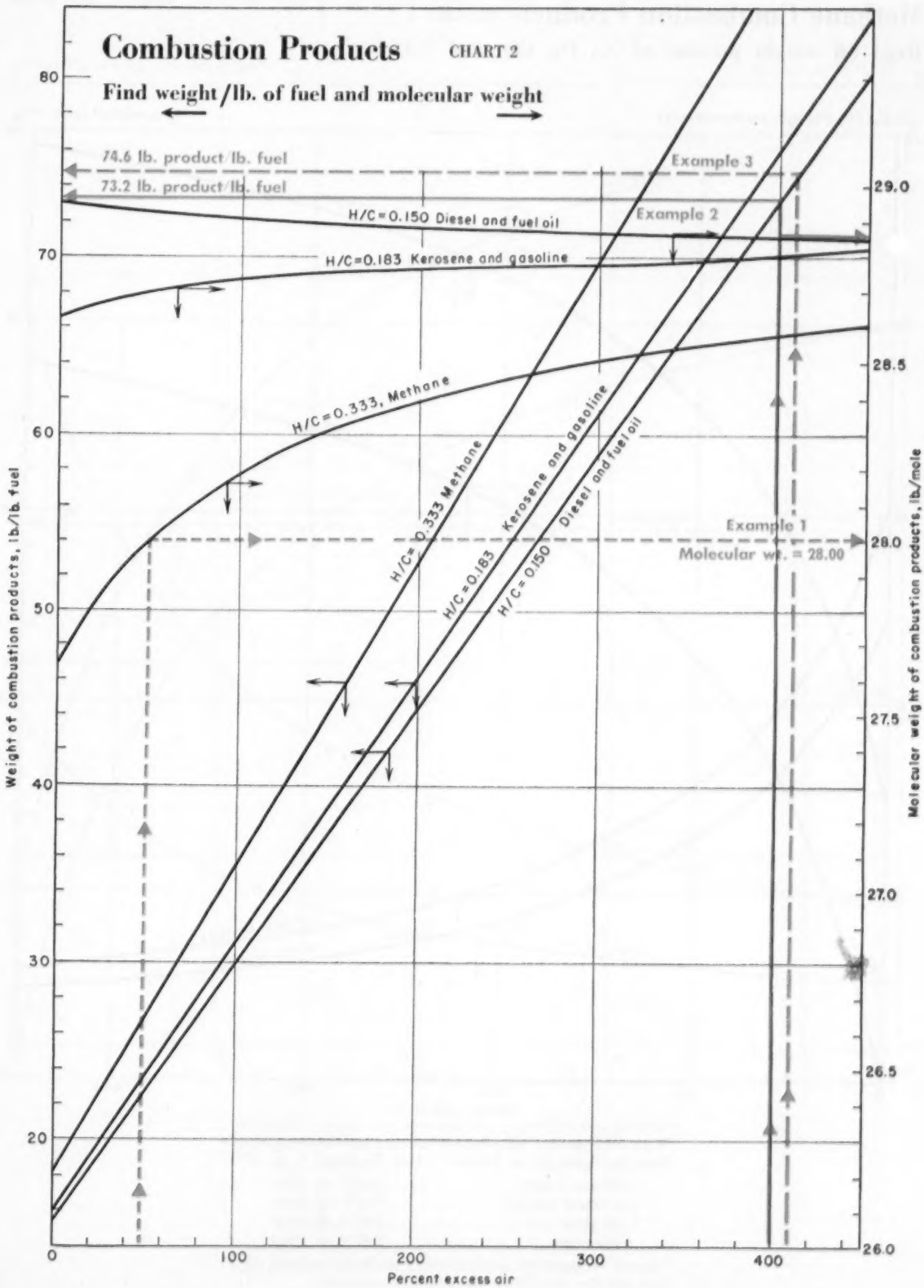
$$WF = \frac{25}{74.6} = 0.335 \text{ lb./sec.}$$

Meet your authors on pp. 347-8.

Heat Balance CHART 1

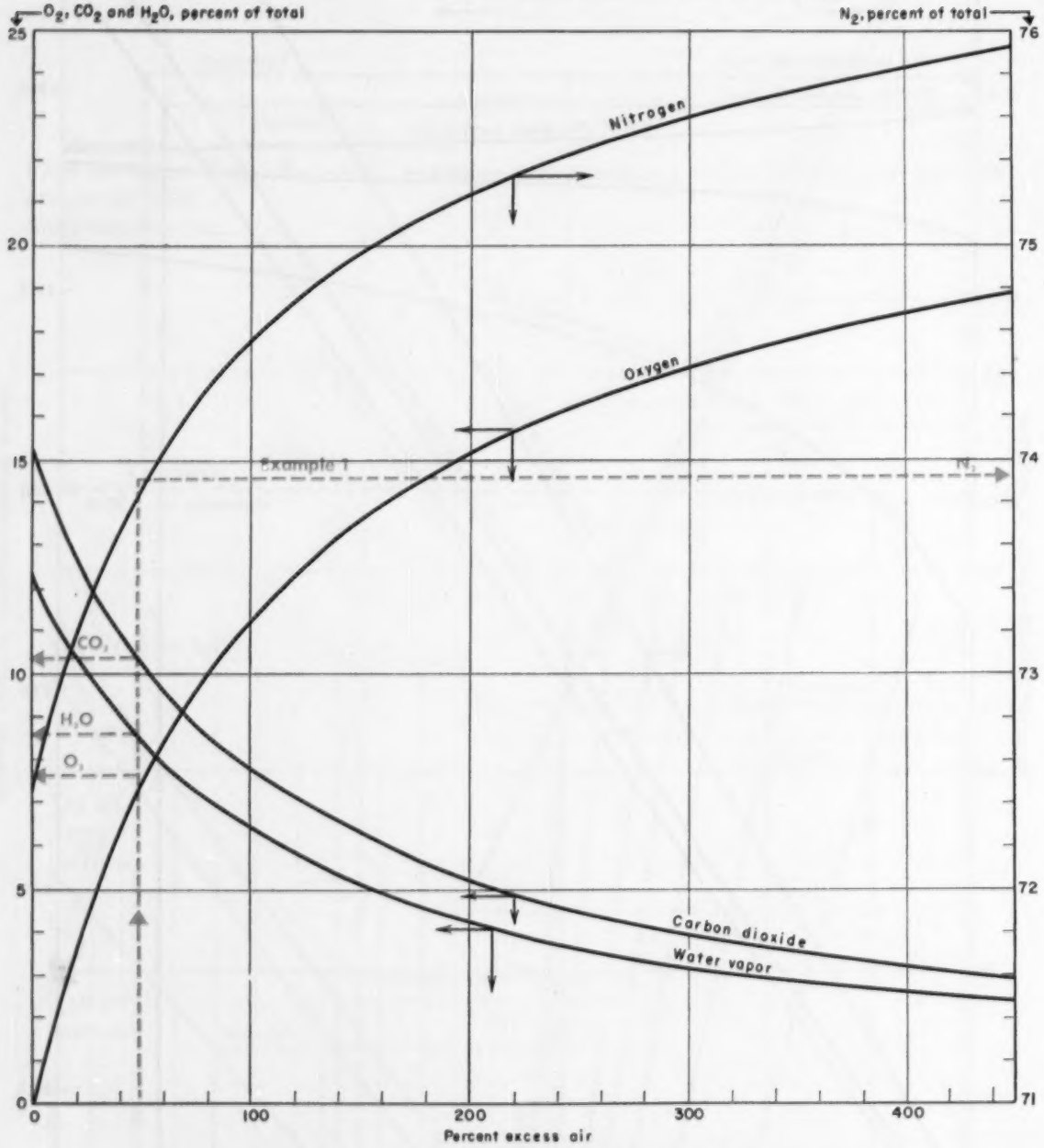
Pick off values for excess air and temperature rise.




Combustion Products
CHART 2
Find weight/lb. of fuel and molecular weight
74.6 lb. product/lb. fuel
73.2 lb. product/lb. fuel
Example 3
Example 2
H/C=0.150 Diesel and fuel oil
H/C=0.183 Kerosene and gasoline
H/C=0.333, Methane
H/C=0.333 Methane
H/C=0.183 Kerosene and gasoline
H/C=0.150 Diesel and fuel oil
Example 1
Molecular wt. = 28.00
Weight of combustion products, lb./lb. fuel
Molecular weight of combustion products, lb./mole
Percent excess air
80
70
60
50
40
30
20
0
100
200
300
400
29.0
28.5
28.0
27.5
27.0
26.5
26.0

Methane Combustion Products CHART 3

Read off weight percent of N_2, O_2, CO_2 and H_2O



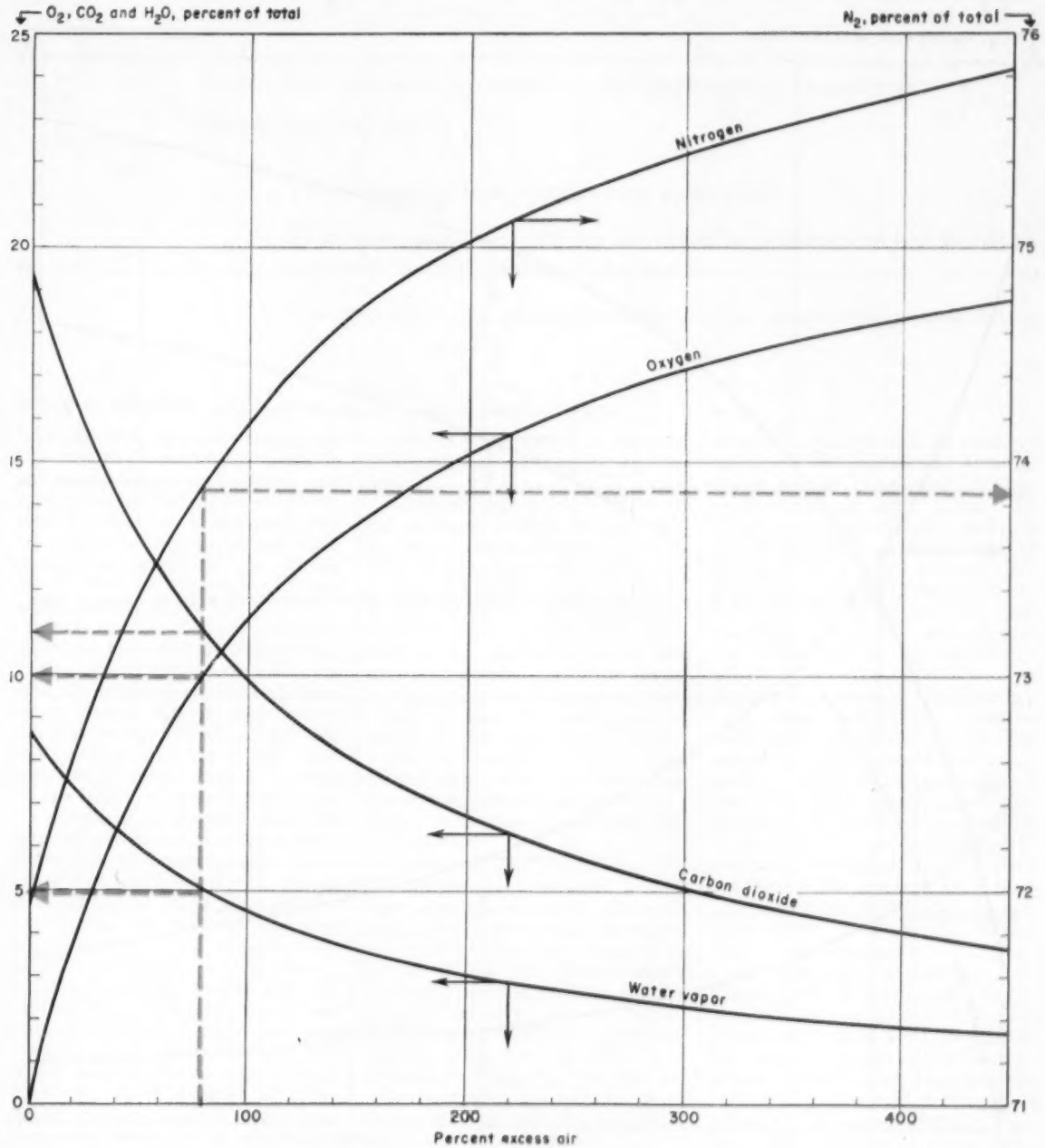
With 50% excess air, composition of combustion products from methane is as follows*: (see Example 1, p. 179):

Water vapor	8.4% of total
Carbon dioxide	10.2% of total
Oxygen	7.55% of total
Nitrogen	73.85% of total

*** Based on complete combustion, pure hydrocarbons, 80 F. fuel and dry air (79% nitrogen, 21% oxygen).**

Gasoline and Kerosene Combustion Products CHART 4

Read off weight percent of N_2, O_2, CO_2 and H_2O



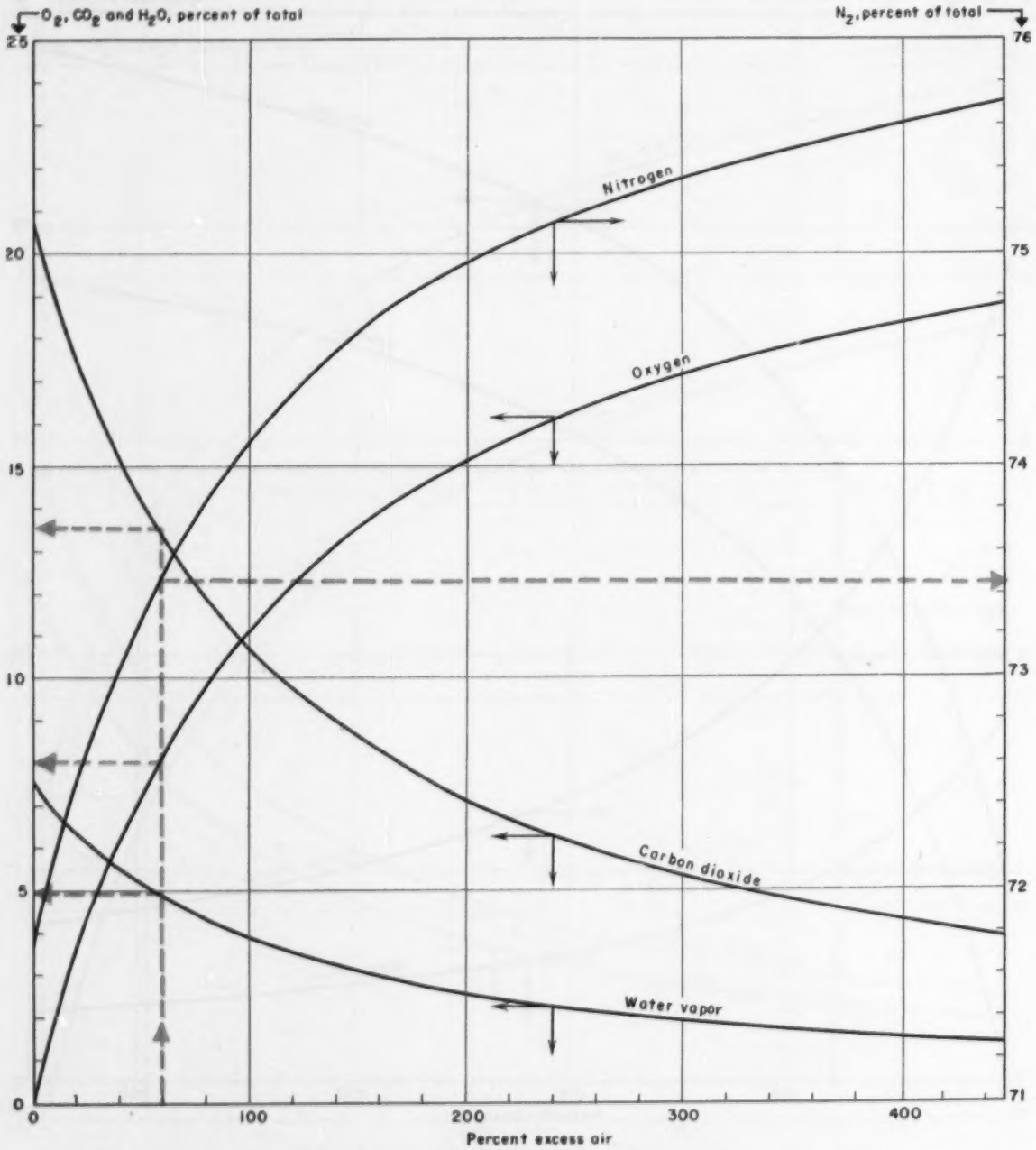
With 80% excess air, composition of combustion products from gasoline and from kerosene is as follows*:

Water vapor	5% of total
Carbon dioxide	11% of total
Oxygen	10% of total
Nitrogen	73.9% of total

* Based on complete combustion, pure hydrocarbons, 80 F. fuel and dry air (79% nitrogen, 21% oxygen).

Diesel and Fuel Oil Combustion Products CHART 5

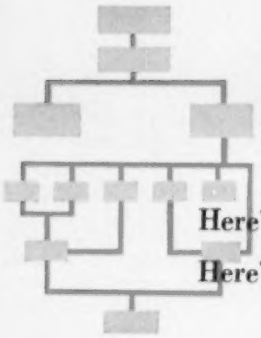
Read off weight percent of N_2, O_2, CO_2 and H_2O



With 60% excess air, composition of combustion products from diesel oil and from fuel oil is as follows*:

Water vapor	5% of total
Carbon dioxide	13.5% of total
Oxygen	8% of total
Nitrogen	73.45% of total

*** Based on complete combustion, pure hydrocarbons, 80 F. fuel and dry air (79% nitrogen, 21% oxygen).**



Organization for Plant Design

Here's how it's done by experts—the engineering contractors

Here's help for you if . . .

. . . Your company uses engineering contractors.

. . . Your company does not use engineering contractors but needs to improve its engineering organization.

. . . You are thinking about working for an engineering contractor.

RYLE L. MILLER, Jr., Bechtel Corp., San Francisco, Calif.*

A relatively new phenomenon on the American industrial scene is the recent accelerated growth and acceptance of the engineering contracting firm as a designer and constructor of process plants. This development came of age during World War II; since then it has grown to maturity.

As a specialist in the organization and execution of engineering design, and in subsequent construction, the engineering contractor has demonstrated that he can operate in this territory more quickly and more economically as a rule than can the manufacturing companies of the chemical process industries.

In many of the process industries, particularly the chemical and petroleum, plants become obsolete comparatively rapidly, which means that there is a steady demand throughout the industry for new plant designs, new construction, and for revamping existing plants.

This is another reason why the engineering contracting firm has come into existence. Expansion and construction projects for any one plant require large numbers of men for short periods of time. When a single manufacturing concern attempts to do its own design and construction it is usually forced into a situation of mass hiring and firing—to which such companies are naturally averse. On the other hand, steady demand for design and construction enables the engineering contractor to develop a stable organization. He can offer permanent employment on this account to a wide variety of the most highly skilled engineering specialists.

* Meet your author on page 349.

Although each plant is different, the engineering skills required for its design are essentially the same. This is generally true within the process industries. It is even true within limits in the general industrial field, except that those engineering contractors who are strong in process plant work necessarily employ many process engineers, whereas their skills are not needed in designing other plants.

Most engineering concerns doing process plant work have therefore found it expedient to organize their design activities in substantially similar ways.

Experience has shown that the engineering required for a new plant design is most efficiently handled by eight specialized groups, all important for successful completion of the job. These include (1) the project engineers; (2) the process engineers; (3) the equipment engineers; (4) the piping designers; (5) the structure and foundation designers; (6) the instrument engineers; (7) the vessel designers; and (8) the electrical engineers.

In what follows we shall first examine the functions of these eight types of specialists; then we shall see how the engineering organization operates with them.

The Eight Specialists

Project Engineer—The duties of the project engineer combine functions which are in both the management and the engineering spheres. These include: (1) representing the contracting company before the client's engineers; (2) defining completely the contractor's work at the start of a given project; (3) promoting the rapid transfer of design information within the contractor's organization; and (4) giving continuity to the project by selecting between equivalent designs with a sense of consistency.

In most contracting concerns these four functions are divided among several engineers on a single project. The first three, which are the ones most closely resembling management functions, are usually handled by the senior engineer of the group, who is called the "project engineer." The last function is then handled by his assistants who are often called "job engineers," rather than project engineers.

In their task of insuring continuity, the job engineers usually prepare the engineering flow diagrams which show all of the piping, equipment and instrumentation required by the process. In many concerns they perform the duties of the equipment engineer described below. The activities of the job engineers cover an extremely wide range and therefore their specialties and educational backgrounds may vary similarly to the other specialists of the contracting company.

Process Engineer—The process engineer is unique among the contractor's engineers. The other specialties may be found working

on designs for steel mills, aircraft plants, or in ship building, as examples. But the process engineer confines himself essentially to the design of process plants for chemicals, pharmaceuticals, petroleum refining, and the like. For this reason process engineers are usually found only in those contracting organizations which specialize in process plant design.

Process engineers are almost always chemical engineers by education and training. Their special capabilities enable them to use basic chemical engineering data in determining the most economical process which will yield the desired plant products. Their second function is to clothe the process in specifications for the design of equipment to be used in the plant. In so doing they use their chemical engineering background in developing special proficiency in the calculations involved in heat and material balances, reactions and their rates, and the unit operations such as distillation, mechanical separations, and fluid flow.

Equipment Engineer—The equipment engineer (or the job engineer, if he assumes the equipment engineer's functions) writes the engineering specifications for equipment such as pumps, heat exchangers, cooling towers and fired heaters, all of which are supplied by subcontracting equipment manufacturers according to more or less standard designs. This function therefore does not assume direct responsibility for the design, which is one reason why it is often handled by the job engineers.

Owing to the wide range of the equipment engineer's activities, his educational background is variable. However, his education is usually in chemical or mechanical engineering.

The equipment engineer's job often calls for a vast fund of specialized knowledge. This follows from the fact that the writing of engineering specifications for the purchase of equipment is exacting and of great importance. These specifications must be so explicit as to limit the equipment manufacturers' offerings to a uniform standard of quality and performance.

Piping Designer—Piping designers comprise the largest group of engineers in the engineering contracting organization. Depending on the type of plant, it may take from 15 to 25 piping designers for each process engineer. This group has the duty of preparing the construction drawings showing the physical layout of all piping and instruments appearing on the engineering flow sheets. Usually the drawings they produce are of two types: "piping drawings" in which the plant is broken into sections, with all piping drawn to scale in plans and elevations; and "isometrics" where each piece of piping is drawn to scale as if viewed from a point in space.

As the number of piping designers required suggests, there is a good deal of variation in the types of engineers needed to complete the piping drawings. Most of the theoretical work, however, will generally be done by the mechanical engineers who must analyze the piping for thermal stresses to permit proper location of pipe supports, loops, bends and expansion joints.

Structure and Foundation Designers—In this group the personnel are usually civil engineers and/or architects. They are responsible for designing the buildings, along with heating and sanitary facilities, as well as the structural supports and foundations for equipment, vessels and piping. In so doing they work from information supplied to them by the other specialities.

Instrument Engineer—With the rapid expansion in instrumentation and its use in process plants, the engineering contractors must be well versed in this field. Almost every plant design incorporates new concepts in the use of automatic process control.

Since instrument engineering is comparatively new, the instrument engineers themselves come from a variety of educational backgrounds. However, most of them have been educated either as chemical or mechanical engineers, and some as electrical engineers. Their main function is to prepare the engineering specifications for purchasing and applying the necessary instruments. Like the electrical equipment, the instrumenation is usually so complex that almost every engineering concern must have its own instrument department.

Vessel Designer—The engineers of this group specialize on the design of all vessel-like equipment, including distilling, absorption and extraction columns, pressure vessels, and tanks. All must match the process requirements as regards operating temperatures and pressures, and outline dimensions.

Vessel designers usually are mechanical engineers, a background which is best for this work. The engineer requires a thorough knowledge of the various codes on which most of his designs must be based. The vessel designer does not make the fabrication drawings for the construction of the vessels, but usually must make design drawings to explain in detail the results of his calculations.

Electrical Engineer—The responsibility for the design of electrical equipment is usually assumed by the equipment manufacturers. However, the equipment is often so complicated that its specification requires the special abilities of electrical engineers. In addition to writing the electrical equipment specifications, they design electrical control systems and prepare drawings which show the layout of electrical conduits and lighting systems in the plant.

The Design Organization

With so many engineering specialties involved, careful organization is necessary within the contracting firm to control the flow of information among the various engineering groups. Fig. 1 may be taken as generally typical of the way in which the problem is handled by engineering contractors.

As we have already seen in discussing the functions of the project engineer, he serves as contact between the client concern and the engineering contractor, establishing the basis of the design, and the project design data. The basis of the design, which includes required capacities for specified products, as well as information on raw materials and utilities available, is transmitted to the process engineer as in Fig. 1. He uses the information in determining optimum sequence of flow and other operating conditions, after which he communicates the process requirements to the job engineer in the form of equipment schedules, vessel sketches, and process flow diagrams.

The project design data secured by the project engineer from the client includes information on code requirements, power sources available, and characteristics of the

plant site. This information in the hands of the job engineers is used to establish the mechanical design of the process equipment, at the same time fitting in with the process requirements as transmitted by the process engineers. The job engineers prepare material requisitions for the purchase of standard equipment available from manufacturers. They also transmit mechanical specifications for the piping to the piping designers, motor requirements to the electrical engineers, and vessel sketches and engineering flow diagrams to the other specialties as needed.

During the early stages of the project the job engineers work with the design engineers in the various groups in preparing the job specifications. These comprise a book of written standards which apply to all design and purchasing for the project.

Although the job engineer has many duties, the bulk of his time is spent in developing the engineering flow diagrams which specify all of the piping, valves and instrumentation in the plant. These diagrams are used as design specifications by both the piping designers and the instrument engineers.

Information from the job engineers is used by the designers and specialized engineers in preparing construction drawings and material requisitions. Construction drawings then go to the plant site for use by the field forces, while the material requisitions go to the purchasing department for their use in procurement.

Service Departments

End products of engineering design are therefore construction drawings, material requisitions for standard equipment to be supplied by others, and design drawings for equipment to be fabricated by the construction forces. The number of these drawings and requisitions required for an average process plant is very great. Add to them the manufacturers' drawings which will be accumulated and you have a major problem in efficient handling. This generally works out as the province of two service departments, one which keeps track of all design drawings and one responsible for the distribution of material requisitions and manufacturers' drawings.

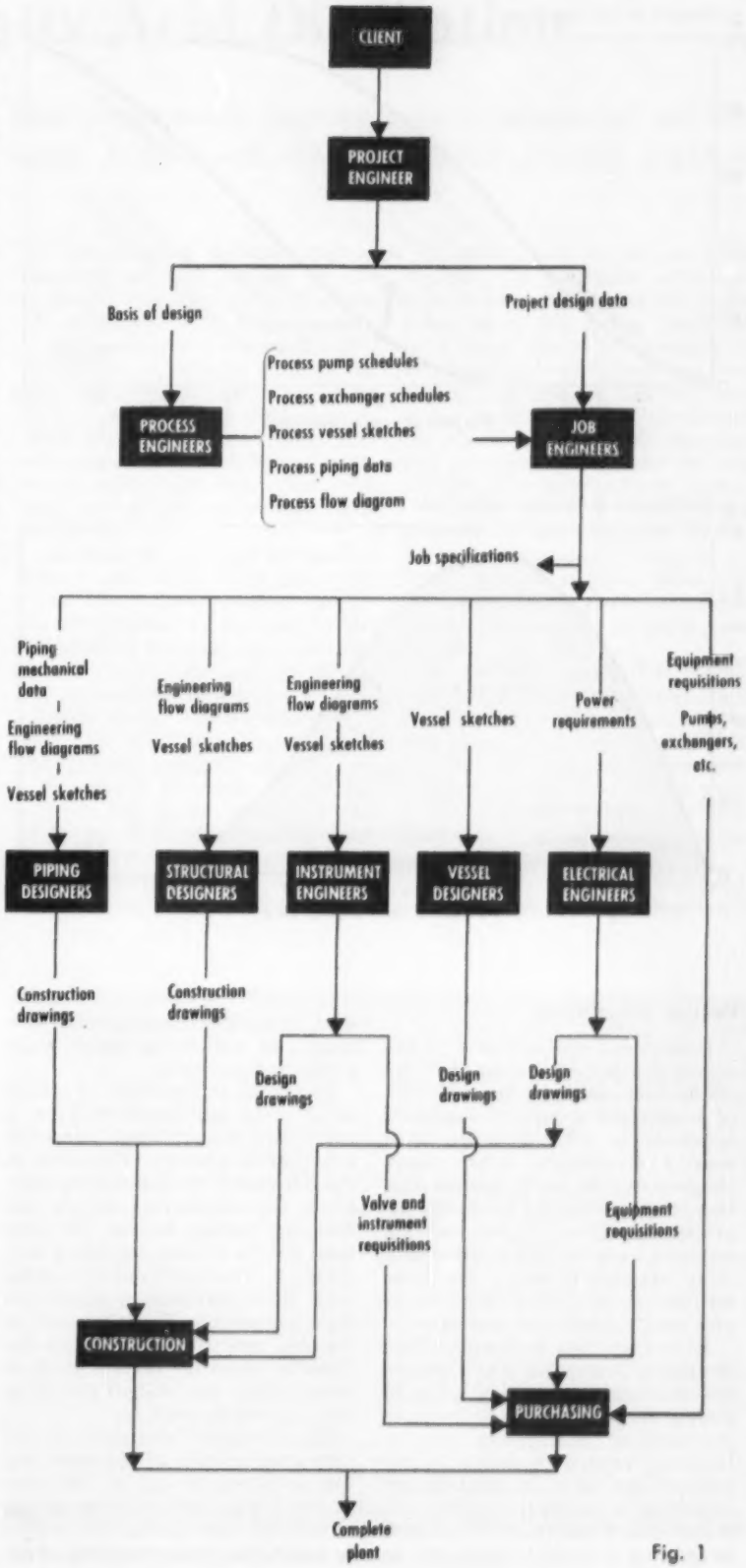


Fig. 1

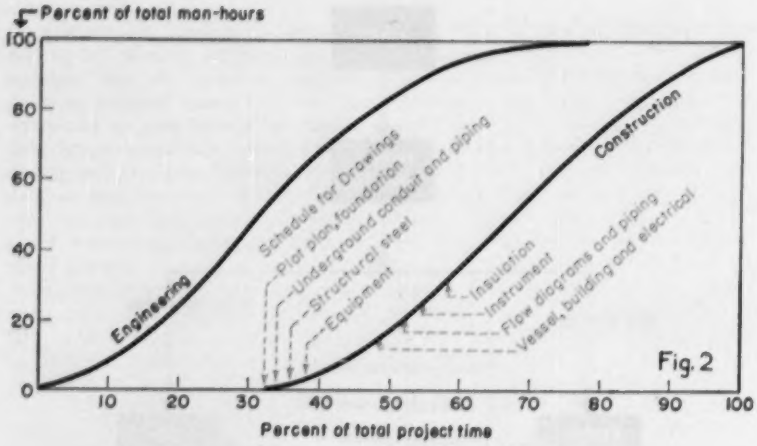


Fig. 2

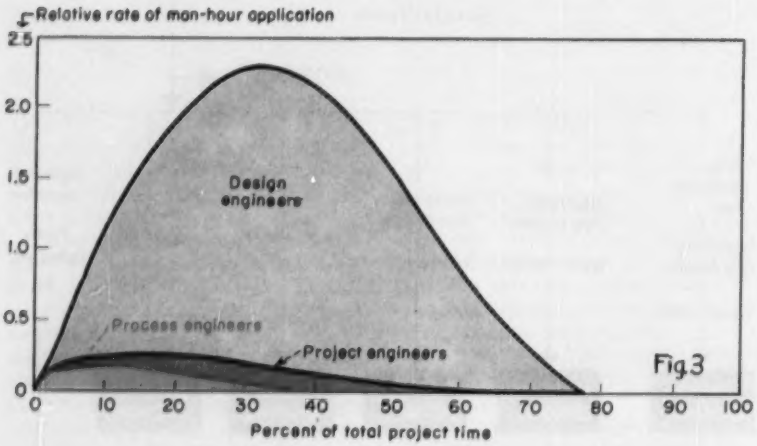


Fig. 3

Design Scheduling

From what we have seen of the design problem it is clear that the efficient scheduling of the activities of some eight groups of engineers is not simple. With the larger engineering contractors where many projects may be on the boards at a time, the possibilities for confusion are legion. Therefore, engineering concerns have learned to use scheduling systems in much the same manner as manufacturing companies use standard cost systems.

It is true that successive plant designs will vary too much to permit the engineering contractor to assign periodic operating costs to the various engineering groups. However, experience makes it possible to analyze each plant design according to the types of equipment it includes. From this it is possible to draw up a schedule which can be used to review organizational efficiency, as well as to assign manpower to the project.

Examples of two types of scheduling curve are shown in Figs. 2 and 3. Fig. 2 is an "ideal" curve for a typical oil refinery. The curve at the left shows the cumulative man-hours for engineering design and drafting, plotted against the total time for the project, including construction. The righthand curve similarly shows cumulative man-hours for construction. Superimposed on the ideal construction curve are the times at which the various kinds of construction and design drawings are required in the field.

The curves are interesting in that they give an idea of the time factors involved, as well as the rates at which manpower must be applied at various times during the project to assure the proper meshing of design and construction activities. It will be noted that with a plant of this type construction starts at about 30% of total project time, but that roughly 50% of engineering time must have been completed. Similarly, work of the engineers is essentially completed with some 30% of project time remaining.

An even better idea of the rate of application of engineering manpower to the project can be obtained from Fig. 3. This is a plot of the time derivative of Fig. 2 against total project time. The ordinate is the rate at which engineering man-hours are being applied at any given time (i.e., the slope of the engineering manpower curve at each instant during the project). Here the curve representing the total rate of manpower application is broken down to show the three main engineering groups: process, project and design engineers.

A chart of this type gives an excellent idea of both the relative numbers of engineers of various types required by the job, and the total amount of time that the several specialties must apply. At any given project time the distances between curves on the ordinate are proportional to the number of different specialities working on the job. The accumulated man-hours for each specialty is proportional to the areas between the curves up to any given fraction of total project time.

Thus if we assume a total of 100 engineers of all types involved on the job at the time of maximum rate of man-hours use, we can derive the following rates of manpower application from the chart:

	At % of Project Time			
Specialty	10	20	30	40
Process	8	4	2	0
Project	12	14	10	5
Design	28	65	88	89
Total	48	83	100	94

Similarly, if we look at the chart from the standpoint of total man-hours, we find that some 5% is expended by the process engineers, 12% by the project engineers, and 83% by the design engineers.

The chart emphasizes the fact that man-hours can be applied to the project at only a fairly low rate during the process design stage. On this account the process design stage is crucial and it is possible for a single man-hour wasted at this time to cause as much delay as 20 man-hours wasted during the production design stage.

Trends in Fatty Acid Distillation

Basic requirements, improvements in equipment, and best design features will aid in your still selection problem.

C. A. LEE, Evanston, Ill.*

There are various reasons for distilling a material besides the original one of purification, and even that one is a matter for definition. There are of course various types of distillation, and differing types of equipment. Whiskey and petroleum are examples which come to mind as suggesting fundamentally different problems.

Techniques for the purification of fatty acid by distillation have been greatly improved in the last 25 years. Fatty acid is made by hydrolyzing fats which ordinarily are collected from many different sources.

When we speak of purified material, we really mean a standardized mixture. The stearic acid of commerce is a eutectic mixture of 45 parts stearic and 55 parts palmitic, with small amounts of oleic acid and the lower homologues. The oleic acid of commerce has a titre point of 9°C. and can easily be produced with a titre point of 5°C. or lower. As true oleic has a melting point of 14°C., it is easy to see that commercial oleic acid is merely the liquid part of the original mixture. It is called "red-oil," although it is many years since the stills produced material dark enough for the material to be red.

Oleic and Stearic Manufacture

For many years, the practical way to make oleic and stearic acids was by a combination of cold and hot pressings. This process is still in extensive use, in spite of fact that it requires a rather definitely maintained mixture of tallow and "grease" in the original batch.

The fatty acid is panned and chilled as required for the oil to meet a certain cold-test. The cakes are wrapped in burlap and the oleic acid pressed out as a product.

The crystalline residual material containing stearic acid is re-panned and hot-pressed under high pressure for squeezing out rest of the oil and the softer crystalline material. No low-melting material is left in the press beyond the small amount adsorbed on the surface of the crystals. This time it is of course the press-cake which is the product.

The pressed-out material, called margarine, is recycled through the cold presses to the extent of about 25% on the basis of stock panned. With the 75% of fresh fatty acid entering system, equilibrium exists throughout, provided that the original batches are properly proportioned.

Mention was made of commercial stearic acid being a eutectic mixture. Fig. 1 shows what is meant. In hot-pressing we squeeze out the low-melting material, and it is correct to say that the material climbs the corresponding portion of the eutectic curve. The complication is that the material is "crystalline" through only a narrow range.

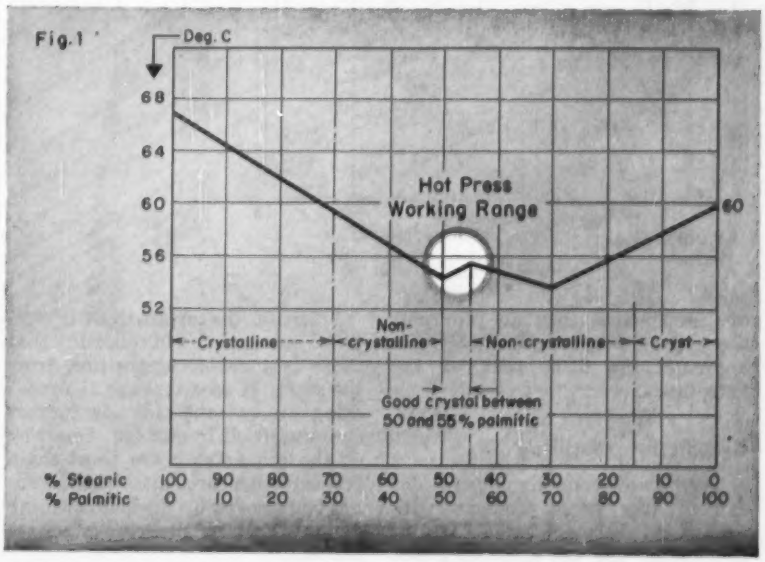
Practically speaking, we are interested only in the middle portion of curve. It is comparatively easy to maintain operations in the 50 to 55% palmitic range, with good "crystal" and easy pressing.

However, two things can cause trouble. An improper admixture may throw material, one way or the other, out of this range. There will be a sharp change in structure. It becomes micro-crystalline, and hard to press. Yields are low and there is too much to recycle. Quality of the stearic acid is poor. Situation will not correct itself, and the best solution is to make a fresh start.

Another source of trouble is the presence of small amounts of the lower homologues. Crystal is reduced in size, and the cakes (although pressable) are not as easy to handle. It is harder to get a good product.

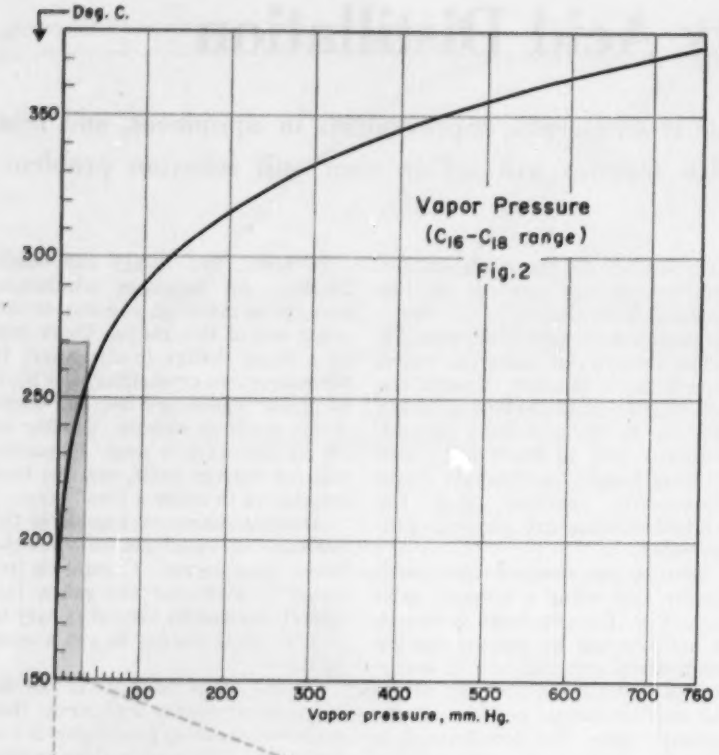
On the other hand, it is the relationships shown on curve that make hot-pressing practicable in the first place. With normal operation, material is crystalline and hot-pressing causes the melting point to climb towards the peak at 55% palmitic. It will never reach the non-crystalline range.

While the terms single-pressed, double-pressed, and triple-pressed



Eutectic curve for stearic-palmitic mixture. (Fig. 1)

*Meet your author on page 250.



are misnomers, they do represent the degree to which the materials approach the 55% peak of the eutectic curve.

Reason for Distilling

The two pressing operations can produce good products with undistilled fatty acid as a base for processing, and the question arises as to why distill in the first place.

Much of the original fatty material is so handled in collecting that there is some decomposition from the start. It goes through the rendering process and there is further decomposition in storage. One way or the other there are short-chain fermentation products which cannot be removed by the acid-washing done before putting the stock to process.

Luckily this undesirable fraction can be removed in the distilling, with proper operation of the condensers. It could also be removed as an "odor-cut" prior to entering the still itself.

When a sample of fatty acid "smells," you do not smell the material in the can. What you smell is something in the air above the can—something that has escaping tendency. In other words, something that exerts appreciable vapor pressure at the temperature of the material in the can.

Of course, the same thing is true of a poor distillate made from rancid material—but a poor distillate is not a necessary product of rancid material. The odorous fraction need not be condensed with the product. The principle applies as well to the so-called distillation odor, which is really due to a trace of acrolein resulting from pyrolysis of neutral material left in the feed-stock. The point is that if you can smell it, the fraction has escaping-tendency and can be removed.

Bases for Design

Some very interesting possibilities are opened up by the charts presented as Figs. 2 and 3.

Fig. 2 is the conventional vapor pressure chart and is drawn for mixed fatty-acids in the neighborhood of C_{16} and C_{18}.

Fig. 3 is a chart for the steam distillation of fatty-acids. It is based on Dalton's Law of Partial Pressures. The law is conventionally stated as:

$$\frac{W_a}{W_b} = \frac{P_a M_a}{P_b M_b}$$

The two components in the vapor are a and b (in this case: fatty acid, with an average molecular weight of 275; and steam, with a molecular weight of 18). W_a/W_b is the weight-ratio of the two components in the vapors. M stands for molecular weight.

Let $W_a/W_b = R$ and let P equal absolute pressure ($P = P_a + P_b$). Then, as the partial pressure from fatty acid vapor equals the vapor pressure ($V.P.$), the formula becomes:

$$P = \left(\frac{275\ V.P.}{18\ R} + V.P.\right) = \left(\frac{275}{18R} + 1\right) \times V.P., \text{ or}$$

$$\log P = \log\left(\frac{275}{18\ R} + 1\right) + \log\ V.P.$$

This formula is very conveniently plotted on semi-log paper as a series of parallel lines depending on various values for R. This chart has never been published before, although the type of chart was explained in *Chem. & Met.*, Aug. 1936. However, it depends entirely upon data which have long been in the public domain.

The chart for steam distillation has three variables of which (within reason) any two may be selected to determine the third. Ordinarily temperature and vacuum (absolute pressure, really) will be selected. R will follow.

Or the statement may be reworded: for any desired temperature, boiling will occur when the sum of the vapor pressure of the fatty acid and the partial pressure of the steam exceeds the absolute pressure in the still. With temperature and absolute pressure held constant, there is a definite ratio for fatty acid to steam in the vapors.

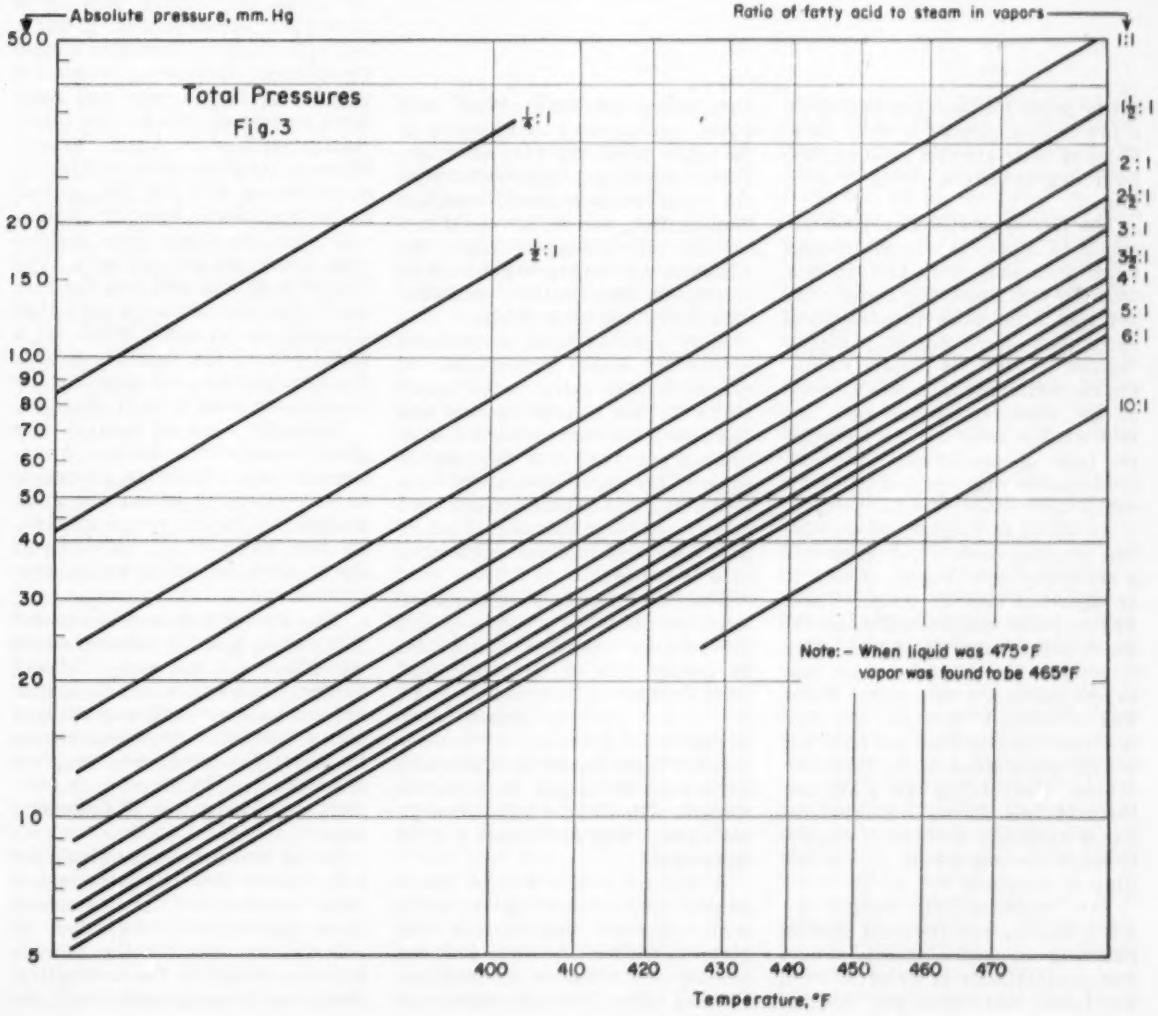
A constant boiling point can be maintained in the still, but this is not true in the condenser. Each pound of material condensed causes R to decrease and lowers the condensing temperature for the next pound. Condensation follows a downward curve.

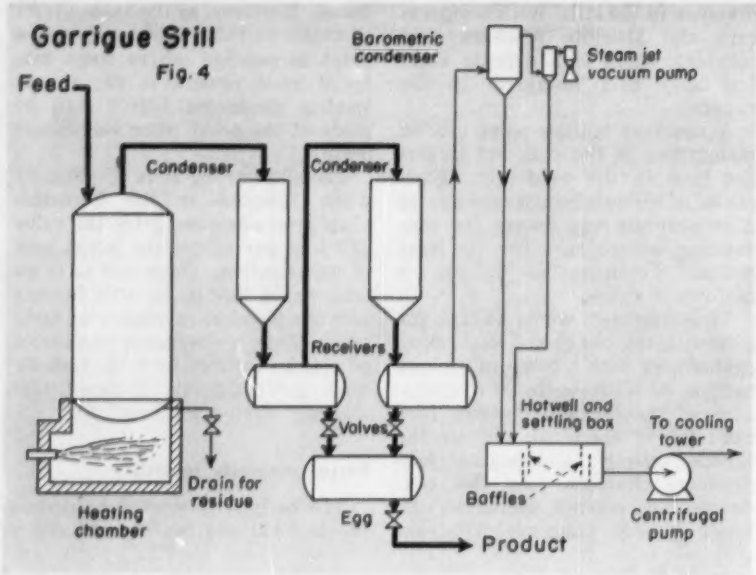
This statement would be true for a pure liquid, but the effect is more pronounced with a mixture such as fatty acid. With controlled temperature of condensing surface, first material to condense will be the higher boiling (and higher condensing) fraction. As the condenser temperature decreases, the lower boiling fractions will condense. However, as the ratio $(1/R)$ of steam to fatty acid builds up, a point is reached where some material must remain in the vapors leaving condenser. More will be made of the point when we discuss design.

The slope of log P vs. T (Fig. 3) when inserted in the Clausius-Clapeyron equation, gives the value 119 Btu. per lb. for the latent heat of vaporization. There will be those who would like to go still further into the physical chemistry of fatty acids. They are referred to a series of articles written by E. L. Lederer and published in *Seifen-Seider Zeitung* during 1929 and 1930.

Improvements in Stills

The early stills were not wonders of chemical engineering but did a





fairly good job and handled quite a few million pounds in their time. Some of them are still running and, with improvements, doing a good job.

The Garrigue still is a good example (Fig. 4). It was direct-fired under a checker work arch to protect the still from the flame. The pot was 2 in. thick cast-iron, and vapor ducts were copper. A copper "spider" furnished "open steam" for its partial pressure effect. None of the steam condensed with the product, but went on to a barometric type of condenser. The noncondensable was pumped out by a submerged-piston vacuum pump.

As shown in diagram, there were two vertical condensers. Each had a hexagonal tube bundle sitting in an open-top tank of water. There was no jacket and no baffling on the water side. Vapor inlet was bolted directly to the top tube sheet, and vapors made a single pass. Water was circulated through the first condenser as required, but level was merely maintained in the final condenser. One of the few good features of this design was that the top of condenser could shift slightly to allow for expansion, or for settling of supports.

The condenser did alright for 1,500 lb./hr., but required careful handling in cold weather. There was no circulation of water between the tubes, and there was unequal distribution of duty. With cold water, condensate would congeal in the outer tubes and plug them up. Vapor would go entirely through the inner tubes without complete condensation, and water would boil out of final condenser while the still-man was trying to get back to normal. In cold weather, operating such a still had its problems.

Many improvements were made in the old stills. A big one, of course, was in going to Sil-fossed joints for the piping. Inconel was introduced for the hot vapors. Continuous pump-out was installed in place of the eggs. Preheaters were introduced and the condensers were revised. Baffling was worked out so that the vertical condensers became easy to control.

The submerged piston pumps were replaced by steam-jets and the vacuum was then controllable by temperature of the "down-leg" from barometric condenser. Some of the improvements cannot fairly be mentioned here, but it was made possible to get a good distillate with quite easy operation. A moderate amount of instrumentation was involved including flowmeters for the open steam.

A natural desire was to find a gentler way of heating the fatty acid. Serious consideration was given to indirect heating with hot oil, and this was done on one of the German stills. It wasn't easy to get the temperature high enough, so they tried higher vacuum so as to lower the boiling point. A direct result was the Gensecke patent, covering a booster, installed ahead of barometric condenser. This made vacuum independent of down-leg temperature.

So far as I know, heating by the circulation of hot oil was not tried on American stills. Some of us even went in the other direction. After a lot of thought, we removed the checker-work arch and heated the still by radiant transfer direct from the flame. A better oil-burner was required (to keep the flame lit), but the results were favorable. We no longer had a mass of red-hot brick which kept on transferring heat after the still was emptied.

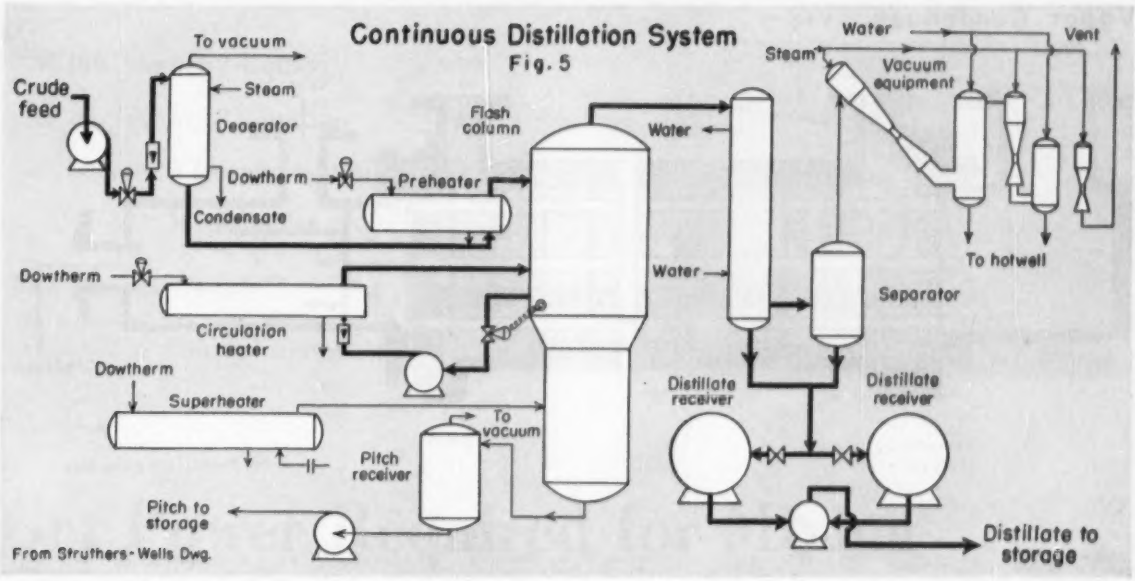
During the early thirties, German engineers were developing new fatty acid stills. One such was built by Lurgi and offered here by a New York representative. It was a pot still made of stainless metals throughout. It made a wonderful product so far as odor and color were concerned. We had no information on how it would "press." We were told they were working on a continuous still but lost contact as the war clouds began to gather.

During the same time, designs were being worked out here. The Wilson & Martin still was the first result. Innovations were such that a patent was granted, which for a while covered the field like a tent. High vacuum was not used, but the product was said to be excellent.

Naturally a lot of thought was given to competitive designs. A reasonable basis for design seemed to be the extension of certain ideas worked out in the petroleum field. On that basis W. C. Hardesty of Dover, Ohio, decided to build a continuous still.

Alan Porter Lee worked out and patented an idea for this still which was effective in two ways. He used a steam-heated preheater to furnish hot condensate, which was sprayed into a fatty acid vapor-condensing chamber. The latent heat required to evaporate 1 lb. of water is sufficient to condense 9 lb. of fatty acid vapor.

To me the idea seems unique, but I do believe that the most important feature is that the extra water vapor has a deodorizing effect. It acts as a carrier for the odorous fraction, including the low-boiling, short-chain compounds and the



traces of acrolein sometimes formed in the still. (If coke appears in the residue strainer, it is evidence of pyrolysis and there will be need for some deodorizing.)

When Armour's continuous fractionating still was successfully developed, it made possible the production of individual fatty acids and markets were developed for them. Crystal is no problem as pressing is not involved. Separation is made with bubble columns, with stripping of the side streams. The set-up is well covered by patents.

Other designs have been worked out for the continuous distillation of fatty acid. At least one produces material for the manufacture of toilet soap. Several are for the distillation of tall oil.

One of the simpler designs is shown in Fig. 5. It is designed to handle high-grade raw material, and produces a superior product. The manufacturer advises that a simple revision is available for handling lower grade raw material.

Another manufacturer has built a simple still which has been used very successfully for certain stocks. The fatty acid distillate is bland and very light in color. Design was by the owner, but he is not ready yet to release information on it. The only reason for mentioning this still is to point up the fact that a complicated design is not required.

Best Design Features

Equipment for a fatty acid still will presumably be made of Inconel or Type 316 stainless steel.

First cost will be high. There will be a natural desire to combine, when possible, several operating features in one piece of equipment. This will cut the cost directly and save space. It will also eliminate connections and reduce chance for leaks in the vapor duct work. Before considering any such combination, it will be desirable to examine the problem in detail.

Vacuum—High vacuum (about 5 mm. abs. pressure) will probably be taken for granted, but I don't know why. Most of the stills with high vacuum do not operate at lowered temperature, but merely with reduced "open steam." At least two continuous stills have produced good distillate without high vacuum, and one of these with higher-than-usual open steam.

My choice would be to install a single booster-stage, and operate at about 15 mm. abs. pressure. In that case, the barometric can operate with a warmer down-leg and any grease that does go over will settle out easily in the hot well. And don't tell me that grease will never go over with the new stills. There is less of a problem in operation and maintenance with a lower vacuum. Also, first cost is reduced.

Heating—The manner in which fatty acid is heated is of obvious importance. Anything done to reduce the time element should help. It would seem desirable to use equipment especially designed for heating and for nothing else. In other words: this unit operation should not be combined with anything else. The idea has been successful in several stills.

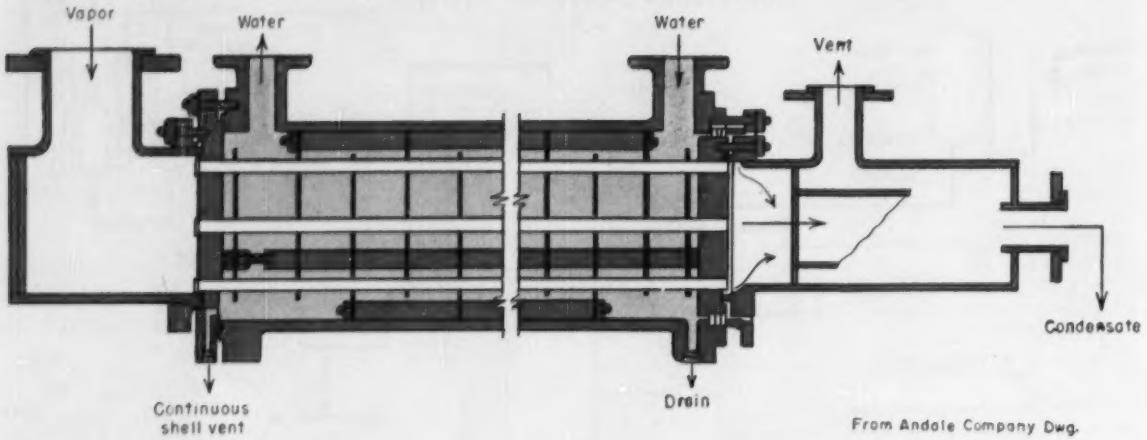
A shell-and-tube, forced-flow heater is the obvious choice. Extra heat can be added if vaporization is permitted in the final pass. (Good design is required.)

Carrying this idea to a logical conclusion, we should consider heating on a once-through basis for a flash-distillation. However, one or two good stills maintain recirculation with its attendant increased time under temperature. There seems to be room for argument here.

Columns — In the conventional fractionating column, liquid flows downward over the trays in countercurrent contact with the ascending vapor. Under equilibrium, there is step-wise variation in concentration with the more volatile material at the top. Its use for fatty acids is covered by patents.

A packed column has been used successfuly merely to provide extended free-surface for completing the vaporization. However, I suggest we consider a column as an

Vapor Condenser Fig 6



From Andale Company Dwg.

exhausting device for stripping the residue from a flash distillation.

On that basis, steam is required as vapor-pressure is reduced by the relatively high concentration in non-volatile material. The stripping steam will be used twice, as it will also furnish partial pressure in the flash chamber.

If recirculation is desired, it can still be provided by heating a side stream and returning it to an upper tray. If the temperature is high enough on the top tray, the heat requirement for stripping can be derived from sensible heat in the material. Or a reboiler can be used in base of column.

Trays have been heated but it does not seem to me that that is the thing to do. With any type of reboiler there will be some coking, and it is well to have it where cleaning is easy.

Condensers — In my estimation, we have reached the really important part of the still.

Assuming an appreciable amount of open-steam, and a properly-designed condenser, we can avoid condensing the 1 or 2% of low-boiling, short-chain material. Or we can easily divide the work between a product condenser and a light-end condenser.

In the first case, we'll get the bad material in the hot-well where we don't want it—but we want it even less in the product. In other words: we really should have the two separate condensers on the basis of good housekeeping. We still have to select the design.

We refer back to the Garrigue still. It was obvious why the condenser design did not retain popularity, although in our case we were able to revise it and make it do a good job.

The newer stills had condensers designed by experts in the petroleum field, whose experience was largely with stills which did the fractionating in the column. Fractional condensation was not at issue.

The idea was to vaporize the material without burning it, to remove the vapors without entrainment, and to condense them efficiently—with a good drop to the distillate pump. In one case at least, it was realized that in cold weather one end of condenser would get pretty well coated with congealed stock, so 15% extra surface was provided.

Most of these condensers were horizontal. The vapors were on the shell-side, entering near one end, and so baffled that they made three passes before leaving near the other end. The condensate dripped off cross-wise, with a short path to a sump which drained off to the pump.

Except for one early still, all materials were of stainless metals and the product had superior color. In some cases the crystal was not quite as good, and sometimes the product had poor stability. Different expedients were tried. The one that worked best was to use hot water for condensing. Then there was no cool condensing surface, even at inlet, and there was little chance for low-boiling material to condense in the product condenser.

The vertical condenser, with vapors going downward through the tubes, is not generally popular. However, as implied above, it may have certain features hard to obtain in a horizontal job. Of incidental importance is the lower first cost of equipment.

For our purpose, the important feature is that there is equilibrium condensation. Contact is maintained between condensate and the vapors for the complete length of passage. Parallel flow can be used. Cool surface at the top will not hurt, as the low-boiling fraction will not remain in the condensate but will be stripped out from the film in flowing down the tube.

These features would seem to be of advantage with other materials, as one well-qualified manufacturer will build no other type. Such a condenser is shown in Fig. 6.

It is too much to expect that general agreement will be reached on the above ideas. However, some features of design deserve more consideration than they seem to have received. If some feature (e.g. high vacuum) be desirable, it should stand analysis.

For what it may be worth, the ideas presented above have 25 years experience (and study) behind them. Some one of them may arouse particular resentment. If the reader can analyze such a one and controvert the reasoning behind it, he will have so advanced his knowledge as not to need further help.

For low viscosity liquids

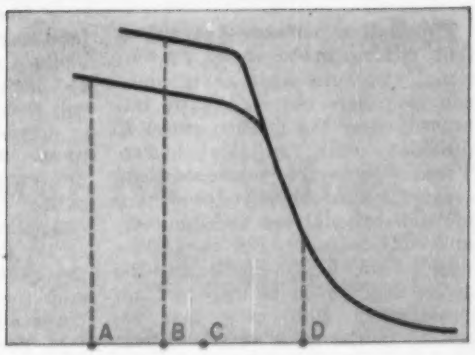
A Mild agitation

B Vigorous agitation

C With baffles

And viscous liquids

D Normal agitation . . .



Get Power Required for Mixing

Chart on the next page gives you a quick estimate of power requirements for most liquid mixing problems. It will greatly simplify your mixing equipment design calculations.

H. E. SERNER, H. E. Serner Co., Oakland, N. J.*

There are many phases of mixing and agitation of interest to chemical engineers, but perhaps none of greater interest then that of power consumption.

Much has been published on this subject, but little in a form that can readily be used by practicing engineers. However, determining power consumption is an essential requirement in any sound design of mixing equipment.

We have developed a generalized, practical and easy method for getting mixing power requirements. It involves the use of a concept well known to chemical engineers—the Reynolds Number. Before explaining the method however, some definitions are in order.

The dimensionless Reynolds Number is an expression of flow conditions in liquids moving in ducts of uniform cross section, at constant velocities. The source of the force required for this motion is located at some distance away.

When flow conditions in a duct have been defined in this way, it's possible to calculate pressure drop per unit surface of the wetted duct area with reasonable accuracy.

* Meet your author on page 251.

Of course entirely different conditions exist, even in the simplest type of mixing vessel, not analogous to the constant flow conditions in a duct. However some simplifying assumptions can be made.

The important surface that affects fluid flow in a mixing vessel is also the wetted wall surface. Friction can be determined with reasonable accuracy by defining the flow conditions that exist only a short distance from this surface.

This is possible in the case of vertical, cylindrical vessels where the fluid is agitated by means of a central impeller. When fluid flow in such a vessel is not impeded by baffles or other obstructions, flow conditions in the vicinity of the wetted wall surface are reasonably constant. Also, under conditions of equal velocity, the flow conditions are similar to that existing in a 12-in. diameter duct.

The choice of the 12-in. diameter is substantiated by data from many installations. It may not be absolutely correct, but the degree of inaccuracy will represent only a small fraction of the safety factor that is applied to every design.

Since power lost in the vessel through friction must equal power input to the impeller, a rational means becomes available for getting power required to produce and maintain any desired agitation.

Using the Chart

The chart shown was developed from the equations for Reynolds Number and power imput. A viscosity was picked, together with a peripheral velocity. Then a N_{Re} was calculated and friction factor picked off the standard curve for commercial steel. Using the values for friction factor and velocity, power was calculated. On the chart fluid velocity (V_p) is plotted against power loss per sq. ft. of wetted surface (HP_w). The chart applies to cylindrical, unbaffled vertical tanks with central impellers. It is based on a specific gravity of 1.0. However, values of power may be corrected within a limited range for other densities by multiplying the chart reading with the specific gravity. For specific gravities in excess of 1.5 determine the correct Reynolds Number and friction factor, then calculate the proper HP_w value.

Correcting for Baffles

Practical experience has shown that mixing produced by conventional impellers such as turbines and propellers can be greatly improved when the mixing vessel is provided with suitable baffles. These change the flow conditions created by the impeller, producing multi-directional flow and innumerable eddy-currents. For good turnover under these conditions, the power input must be increased approximately 50% over that required in the same vessel without obstructing baffles.

When the mixing vessel is equipped with baffles or other flow obstructions, power consumption of the impeller, operating at the same speed, is increased. The entrance velocity of the fluid to the impeller is reduced and the impeller therefore does more work.

When the fluid to be agitated or mixed in a tank without baffles, has a high resistance to flow, the flow pattern in the mixing vessel undergoes a complete change. No longer does the fluid in the tank flow in concentric circles. The friction effect of the wetted wall surface may become so great that the linear velocity along the wall will be almost imperceptible; the fluid will rise slowly toward the surface or descend toward the bottom next to the wall, and accelerate toward the center of the vessel in a spiral path.

Application of tank baffles, to increase the mixing effect, is out of the question. They would tend to stop the flow. For practical purposes agitation within the turbulent flow range is virtually not considered at viscosities above 1,000 centipoises.

Nomenclature

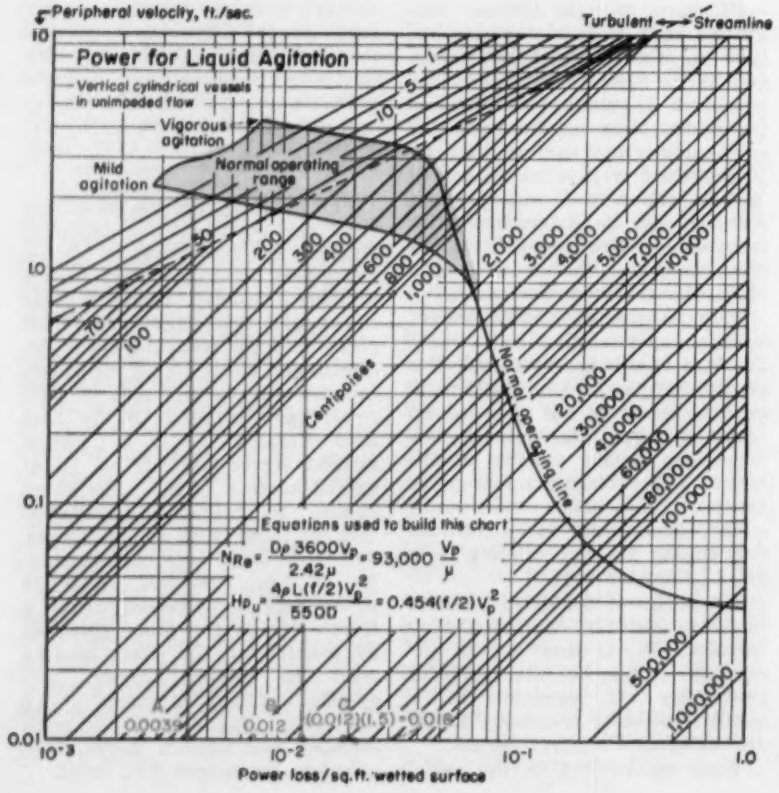
N_{Re}	Reynolds No.
Hp_u	Unit power requirement, hp./sq.ft. wetted surface
$f/_2$	Friction factor
V_p	Peripheral velocity of liquid, ft./sec.
V	Average velocity of liquid, ft./sec.
D	Diameter of duct = 1.0 ft.
L	Length of duct = 1.0 ft.
ρ	Density of liquid = 62.43 lb./cu.ft.
μ	Viscosity of liquid, cp.

Normal Operating Curves

The zone between the two curved lines on the chart indicates the *normal* range of power applied for agitation and/or mixing in simple vessels under unimpeded flow conditions. This zone becomes narrower as the viscosity increases. It is reduced to a single line where it reaches that viscosity at which turbulent flow would be impractical, and baffles would only represent an impediment to flow and mixing.

A Problem—High Viscosity

When the viscosity of the fluid, or its resistance to flow, is very high, another phenomenon may appear: insufficient power input will fail to create complete agitation of the vessels contents. The fluid motion will be restricted to a certain distance from the impeller, and the fluid in the vicinity of the tank wall will remain motionless. This limitation of the fluid movement



Let's Work An Example

600 gal. of two miscible liquids are to be mixed. The specific gravity of the mixture is 1.0., the viscosity 1.0 centipoise. Mixing vessel is 5 ft. in dia., by 5 ft. high with a flat bottom. Liquid level is 49-in. high, and total wetted surface (TWS) is 83.6 sq. ft. What is hp. required for mixing?

A *Mild Agitation* — Follow the curve for 1.0 cp. up to the intersection with the guide line marked "mild agitation." On the abscissa read $HP_u = 0.0039$, and V_p (on the ordinate) = 2.1 ft./sec. The power required for mixing $hp. = HP_u \times TWS \times$ sp. gr. $= 0.0039 \times 83.6 \times 1.0 = 0.326$.

B *Vigorous Agitation*—If the liquids are difficult to mix, follow the curve for 1.0 centipoise to the intersection with guide line marked "vigorous agitation." Read on the abscissa $HP_u = 0.012$. Power required for mixing: $0.012 \times 83.6 \times 1.0 = 1.0$

C *With Baffles*—If it is desirable to avoid vortex formation, and/or to accomplish mixing in the shortest possible time, provide the tank with suitable vertical baffles and multiply the calculated hp. value by 1.5.

may be defined by the term effective radius of agitation.

It means that an impeller, imparting motion to the surrounding fluid, is able to create such motion only within a certain distance from its point of operation. The length of this distance depends on the power input and the fluid discharge velocity from the impeller.

Since turbulent flow cannot readily be produced in fluids of high viscosity, the single line into which the above mentioned operating zone converges on the chart, indicates the power input required to effect *reasonably adequate* conditions of streamline flow. The power input may of course be increased, but the mixing effect will not be greatly effected. In such situations impeller design becomes a vital factor, greatly influencing mixing effect. In less viscous fluids, impeller design is not nearly as critical. But in viscous mixing, impellers that create special effects can be very useful.

Chart Helps Design

The time required, the type and the degree of agitation needed, to accomplish mixing is only predictable when the physical characteristics of the materials are known; when the mixing operation is simple; or when it is comparable to other known operations. In such cases the use of the chart is applicable to the design of mixing equipment.

Small scale tests are frequently necessary when the characteristics of the materials, and their behaviour in relation to each other, are not known. But it is advisable to proceed with caution. Available small mixing apparatus is frequently used for this purpose. To get equal results in large scale applications, the operating conditions in the large apparatus must be a duplication of those that existed in the small test unit. For instance, in a small vessel with a total wetted surface of 100 sq. ft. a satisfactory result is obtained by the use of a certain impeller and a power consumption of 1 hp. A 10 hp. motor would be required for a similar result in a tank with 1,000 sq. ft. wetted surface and similar proportions.

If less power input is provided, the result may differ from that in the smaller vessel.

Easy Method for Sizing Modular Heat Exchangers

Here are easy-to-use charts which will help you in designing an optimum system made up of modular heat exchanger units. These units are now available in most materials of construction and are standard, stock items.

R. L. CALLARD, Corning Glass Works, Corning, N. Y.*

MODULAR heat exchangers are becoming more and more popular with chemical engineers for a number of reasons. They are available in most materials of construction—metal, graphite, glass. They have a low first cost by virtue of mass production.

The "do it yourself" aspects of modulars permit you to build a specific heat-exchanger assembly from standard units. Also, when a process becomes obsolete, the modules can be used elsewhere in different combinations.

This discussion will suggest a set of simple charts for estimating and sizing modular heat exchangers. These charts can save much valuable time for an engineer, for in most cases a technician can be trained to use the charts. He can also tabulate the results, and submit the tabulation to an engineer for interpretation and selection of the best combination of modular units.

The charts were prepared primarily for the line of Pyrex brand heat exchangers manufactured by Corning. However, they can be used for any heat exchanger of the same size range.

Charts will give you h_i, h_o, overall U and Δt_m. A correlation is also given for pressure drop, but a chart must be constructed for each particular make of exchanger.

* Meet your author on page 352.

Put the Charts to Work

The basic equations (see McAdams, W. H., "Heat Transmission," sec. ed.) for the U chart—Fig. 2—are

$$\frac{h_i D_i}{k} = 0.023 \left(\frac{D_i G}{\mu}\right)^{0.8} \left(\frac{c_p\,\mu}{k}\right)^{0.3} \quad \text{for cooling}$$

$$\frac{h_i D_i}{k} = 0.023 \left(\frac{D_i G}{\mu}\right)^{0.8} \left(\frac{c_p\,\mu}{k}\right)^{0.4} \quad \text{for heating}$$

Thus the charts are applicable where:

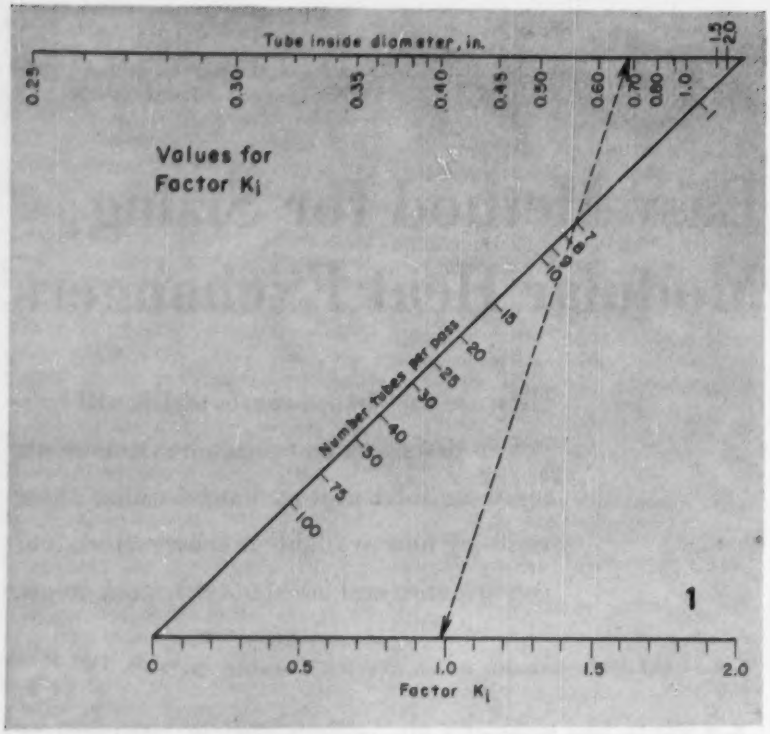
- Reynold's Number is greater than 2,100.
- Viscosity not more than twice that of water. At N_{Re} values larger than 10,000 the equations are applicable to viscosities greater than twice water.
- Properties are evaluated at mean bulk fluid temperatures. For design purposes

$h_i = K_i X_i M^{0.8}$ for cooling

$h_i = K_i X_i M^{0.8} (c_p\,\mu/k)^{0.1}$ for heating

Where $K_i = 0.023/D_i^{0.8} A_{si}^{0.8}$ if units are in feet. For inches $K_i = 2.38/d_i^{1.8} N^{0.8}$, where d_i is tube I.D., and N is total no. of tubes. Here $X_i = c_p^{0.3} k^{0.7}/\mu^{0.8}$.

Now you can see how to use Fig.



2 to get h_i. Just feed in values of viscosity, specific heat, thermal conductivity, mass flow and K_i. To decrease the calculations values of K_i have been plotted against d_i and N in Fig. 1.

Getting Outside Coefficients

For shell and tube units, the equation for h_o recommended by McAdams:

$$\frac{h_o D_e}{k} = 0.33 \left(\frac{c_p\,\mu}{k}\right)^{1/3} \left(\frac{D_e\,G_{max}}{\mu}\right)^{0.6}$$

Our work on glass exchangers indicates satisfactory correlation using properties at the mean terminal temperatures for the units involved, omitting the 0.6 correction factor for baffle leaks. Values were computed for water at 75 F. at various velocities. For cascade units we assume h_o is 500. For jacketed units, values can be estimated with the Nusselt equation.

In the great majority of cases, these assumptions are sufficiently accurate for estimating purposes. But if a particular problem indicates that these assumptions do not hold, it is a simple matter to calculate a few values of h_o and spot them on the chart.

The correlation can be rewritten as

$$h_o = \left(\frac{0.33}{A_{zo}^{0.6}\,D_o^{0.4}}\right)\left(\frac{c_p^{0.33}\,k^{0.67}}{\mu^{0.27}}\right)M^{0.6}$$

where M is lb./hr. of jacket fluid.

$X_o = c_p^{0.33}\,k^{0.67}/\mu^{0.27}$

$K_4 = 0.33/A_{zo}^{0.6}\,D_o^{0.4}$

Then

$h_o = K_4\,X_o\,M^{0.6}$

For water in jacket at 75 F. average temp.:

$M^{0.6} = 165.8\ (\text{gpm.}/10)^{0.6}$

and

$X_o = 0.397$

Then

$h_o = 66.3\,K_4\ (\text{gpm.}/10)^{0.6}$

Changing values of A_{zo} and D_o to inches we get a new constant:

$K_o = 1160/a^{0.6}\,d_o^{0.4}$

Where a is the free flow area between baffles and tubes in sq. in. and d_o is equal to tube O.D. in inches. Then

$$h_o = \frac{1160}{a^{0.6}\,d_o^{0.4}}\left(\frac{\text{gpm.}}{10}\right)^{0.6}$$

where

$a = (d_s - nd_o)\,L$

d_s = shell I.D., in.

n = no. tubes center row

L = baffle spacing, in.

This equation is charted in Fig. 3.

Now with the h_o value, go back to the U chart and get over-all U, assuming a value for h_s, scaling coefficient.

Note that values of h_i should be corrected by the factor $(N_{Pr})^{0.1}$ when the tube side fluid is heated.

With U, the surface area can be calculated. Fig. 4 may be used in getting the log mean temperature difference.

Nomenclature

h_o	Outside film coefficient, Btu./hr. sq. ft. F.
h_i	Inside film coefficient, Btu./hr. sq. ft. F.
h_s	Scale film coefficient, Btu./hr. sq. ft. F. See note, p 199.
U	Over-all coefficient, Btu./hr. sq. ft. F.
M	Mass flow rate in tubes, lb./hr.
G	Mass velocity, lb./hr. sq. ft.
D_i	Tube inside dia., ft.
d_i	Tube inside dia., in.
D_o	Tube outside dia., ft.
d_o	Tube outside dia., in.
d_s	Shell inside dia., in.
D_s	Shell inside dia., ft.
L	Baffle spacing, in.
N	Total number of tubes
n	Number tubes in center row
A_{zi}	Total tube inside cross sectional area, sq. ft.
A_{zo}	Free flow cross-sectional area between baffles at center line of tubes
V	Velocity, ft./hr.
F_i, F_o	Friction pressure drop, inside and outside tubes, one unit, lb./sq. in.
μ	Viscosity, lb./ft. hr.
c_p	Specific heat constant pressure, Btu./lb. F.
k	Thermal conductivity, Btu./hr. sq. ft. F/ft.
ρ	Density, lb./cu. ft.

Friction Losses

We used two equations for friction drop based on the Fanning equation:

$F_i = \alpha\,V^{\beta}\,\mu^{0.2}\,\rho^{0.8}$

$F_o = \gamma\,V^{\delta}\,\mu^{0.15}\,\rho^{0.85}$

for the shell and tube units, where α, β, γ, δ are empirical constants based on experimental data for each unit. These constants can be obtained from manufacturers, and charts constructed.

The technician can now tabulate the following attributes of each of several possible systems of modular

How to Use the Chart

1 First feed in values of viscosity, specific heat and thermal conductivity into the top part of the chart.

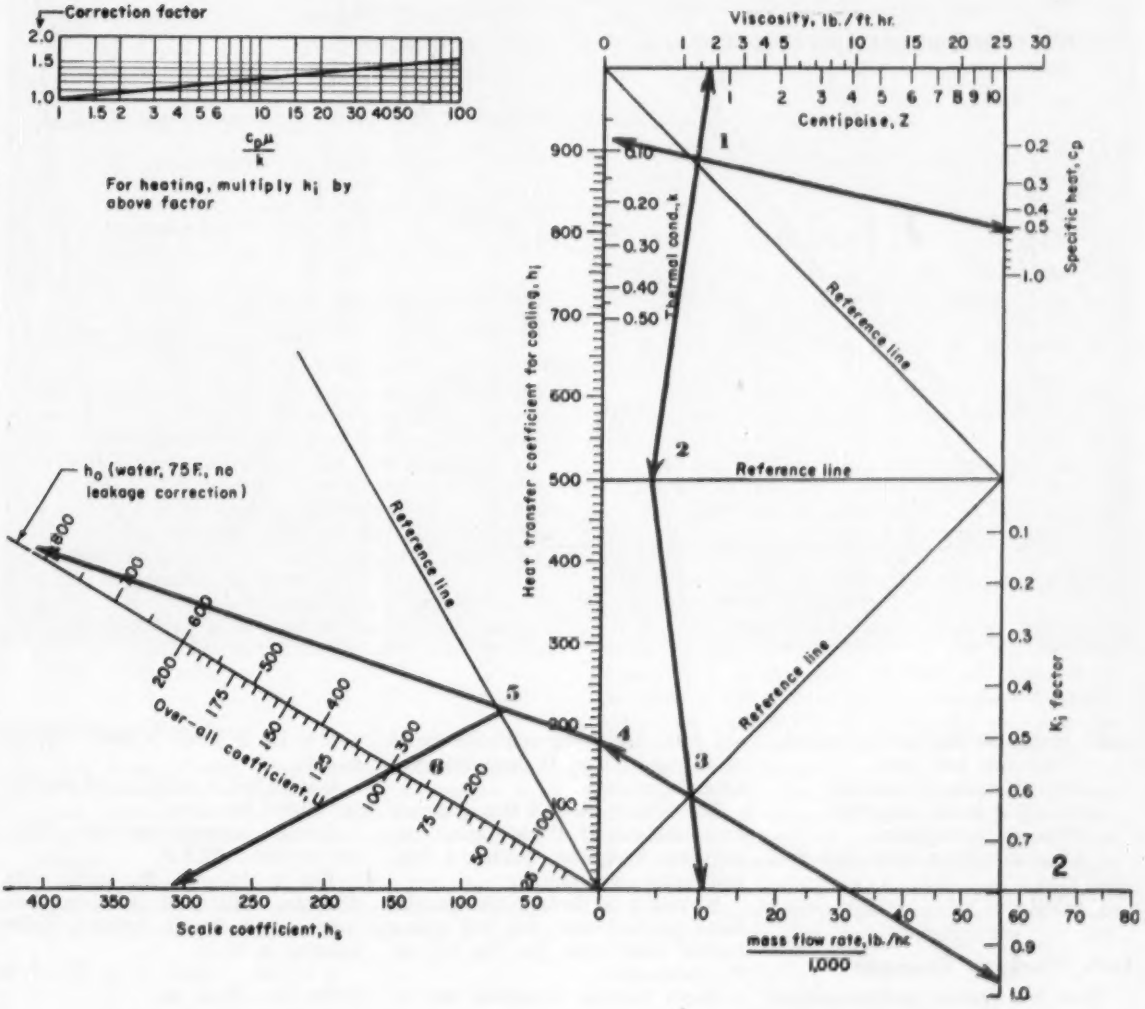
2 Find the intersection point on the horizontal line.

3 Draw a line from this point to the mass flow rate line. This intersects the diagonal reference line.

4 Now draw a line through the diagonal reference intersection and the value for K_i (Fig. 1). This gives h_i.

5 A line through this h_i value and h_o (Fig. 3) intersects the reference line.

6 Over-all U is taken from the intersection of a line through the reference line point and the value for scale coefficient, h_s.



Equations Used to Derive the Chart

$$\frac{h_i D_i}{k} = 0.023 \left(\frac{D_i G}{\mu}\right)^{0.8} \left(\frac{c_p\,\mu}{k}\right)^{0.3}$$

Or

$$h_i = K_i\, X_i\, M^{0.8}$$

where

$$X_i = c_p^{0.3}\, k^{0.7}/\mu$$

$$K_i = 0.023/D_i^{0.2}\, A_{ri}^{0.8}$$

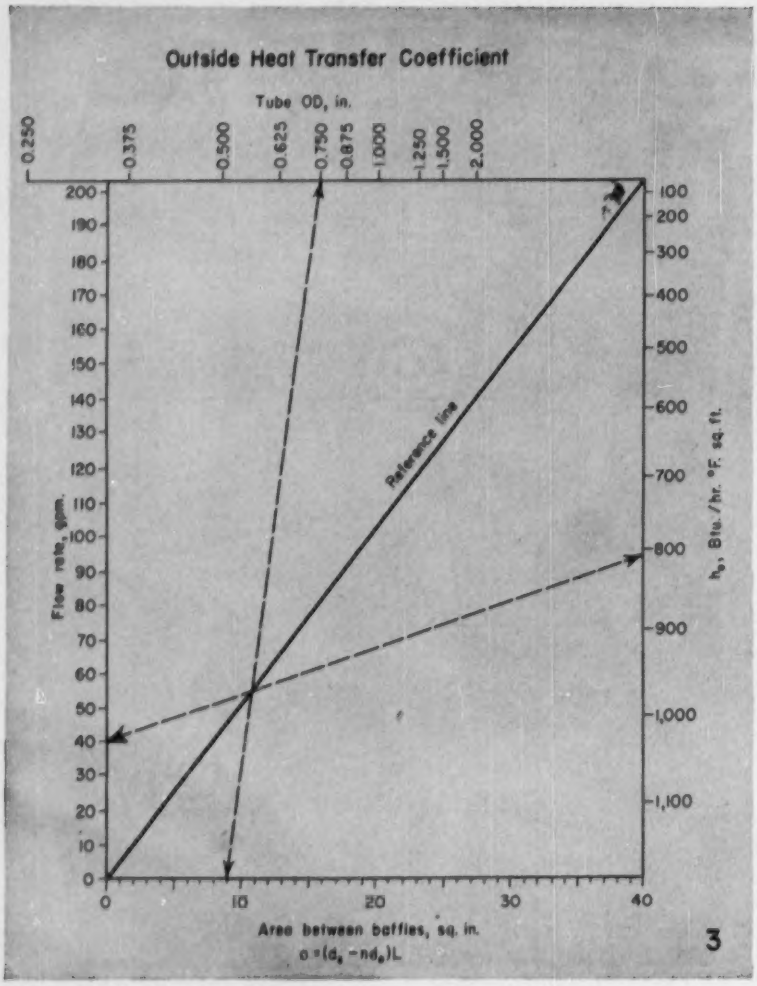
$$\frac{h_o D_o}{k} = 0.33 \left(\frac{c_p\,\mu}{k}\right)^{1/3} \left(\frac{D_o G}{\mu}\right)^{0.6}$$

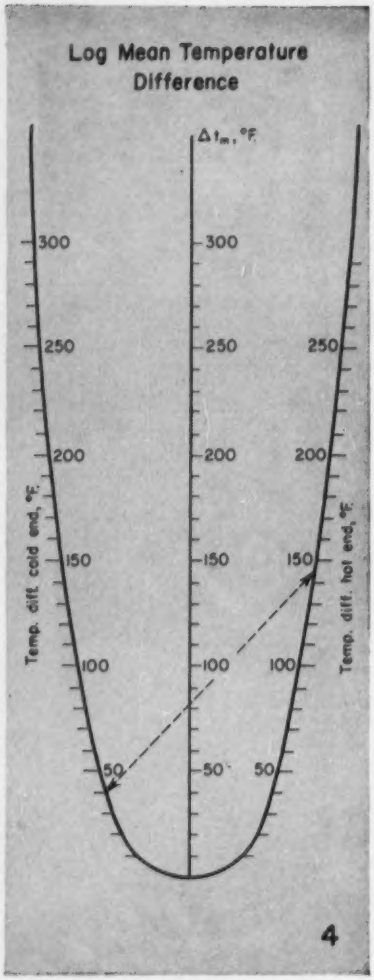
Or

$$h_o = \frac{1160}{d^{0.4} d_o^{0.4}} \left(\frac{\text{gpm.}}{10}\right)^{0.6}$$

$$1/U = 1/h_i + 1/h_o + 1/h_s$$

Note: The wall coefficient is considered negligible for metals. In the case of glass and ceramics the wall coefficient is important but scale formation is negligible —use h_s as the wall coefficient. For metals h_s is the combined scale coefficient for outside and inside the tubes.





units to handle the duty required:

- Unit size and type
- No. of units in parallel
- Cooling water required
- No. units required
- Pressure drop, tube side and shell side
- Cost

Let's Work an Example

Here is a typical problem solved with the aid of the charts. You want to cool 19 gpm. of 100% acetic acid from 244 F. to 100 F. Silty river water is available at 60 F. Plant conditions require minimizing water consumption as water is available in limited quantities.

Modular coolers are available from a supplier. They are constructed of suitable material. Cascade tubes of 1¼, 2 and 3 in. nominal size, and shell-and-tube units of 13½ and 50 sq. ft. heat transfer area are in stock.

The idea is to find the optimum combinations of these units, considering first cost, pressure drop and water consumption.

We won't go through the calculations for each unit, but will pick a typical calculation for the 13½ sq. ft. exchanger.

From Perry's handbook the sp. gr., viscosity, thermal conductivity and specific heat are: 1.049, 1.55 lb./ft. hr., 0.085 Btu./hr. ft. F./ft. and 0.522 respectively. Scaling coefficient is 330 Btu./hr. ft. F. for silty water.

Heat Balance and Selection

Try 40 gpm. cooling water or 20,000 lb./hr.

$M = 19 \times 1.049 \times 500 = 10{,}000$ lb./hr.

$Q = 10{,}000 \times 0.522 \times (244\text{-}100) = 750{,}000$ Btu./hr.

Coolant temperature rise = 750,000/20,000 = 37.5 F.

For a 13½ sq. ft. unit, with 0.750-in. O.D. and 0.690-in. I.D. tubes, shell dia. is 3.00 in. Baffle spacing is 12 in.

$a = (d_s - nd_o)\ L = (3 - 3 \times 0.75)\ 12 = 9$ sq. in.

h_o (from chart) is 807

$K_t = 0.98$ where N is 7 (from chart)

$U = 98$

$\Delta t_m = 82$ F.

A = 93.2 sq. ft. or 7 units of the 13½ sq. ft. exchanger.

F_s = 3.0 lb./sq. in. per unit or 3 x 7 = 21 lb./sq. in.

$F_t = 0.4$ lb./sq. in. per unit or 7 x 0.4 = 2.8 lb./sq. in.

Chemical Engineering Fundamentals

Catalytic Reactor Design Problems—I

How much catalyst do we need? What size and type of reactor will give us the required production capacity and conversion?

T. E. Corrigan and W. C. Mills, Olin Mathieson Chemical Corp., Brandenburg, Ky.

USING methods that we have already discussed (*Chem. Eng.*, April through July, 1955) we can obtain and interpret experimental kinetic data for a chemical reaction. We can also obtain a reliable rate equation and postulate a mechanism for the chemical reaction.

The important chemical engineering problem, though, is to use this rate equation to help select and size a catalytic reactor.

As we explained in the series on the interpretation of kinetic data, if the rate equation is reliable over the desired range of design conditions, it makes no difference whether the equation is empirical or is one derived from theoretical considerations.

If the equation works, it will give us an answer. And there is really no assurance that an elegant theoretical equation, derived from hypothetical mechanisms, will give a more reliable design than a simple empirical equation.

Granted that the empirical rate equation will not tell us anything about the mechanism. But it can give us a reliable reactor design. And that is what we are really after.

The Basic Problem

Our basic process design problem in the design of a heterogeneous reactor is to determine how much catalyst we need and what size reactor we need for the desired production capacity and conversion.

In the case of a fixed-bed reactor, the amount of catalyst and the reactor size are directly related. In a fluidized-bed reactor, the relation is not so direct because the bed density changes with the gas velocity.

Three Ways to Operate

In this installment and the two that follow, we will show how to calculate the reactor size and amount of catalyst needed for fixed-bed reactors.

There are three basic modes of operation for chemical reactors:

- Isothermal. There is enough heat transfer into or out of the reactor to maintain a constant temperature.
- Adiabatic. There is no heat transfer into or out of the reactor.
- Nonisothermal, nonadiabatic. There is some heat transfer into or out of the reactor, but it is not equal to the heat of reaction.

Most commercial chemical reactors are operated as nonisothermal, nonadiabatic reactors.

The isothermal case is the easiest for us to calculate because at any stage in the reaction the temperature is the same. Therefore, there is no variation in the value of the rate constant, k, or the adsorption equilibrium constant, K_A, etc. We can size an isothermal reactor without resorting to trial-and-error calculations.

In an adiabatic reaction the temperature changes constantly as the reaction proceeds and, therefore, the rate and adsorption constants change continually. However, we can use a heat balance to relate temperature to the degree of conversion. Since the values of the constants will already be related to the temperature, they can be estimated for any

Here's Your Guide to the Series on Catalytic Reactor Design Problems

In This Issue	Next Month	To Follow
Isothermal reactor. Heat transfer at reactor holds the temperature constant.	Adiabatic reactor. There is no heat transfer into or out of the reactor.	Nonisothermal, nonadiabatic reactor. By far the most important industrial case.

Procedure to Find

Lb. of Catalyst / Lb. of Feed

Isothermal System

1. Get values for the reaction rate constants at the temperature of the reaction.
2. Solve for partial pressures—via material balances—and put into the rate equation.
3. Calculate and tabulate values of reaction rate for various degrees of conversion.
4. Plot the reciprocal of the rate of reaction against the degree of conversion.
5. Integrate for total area under the curve. This is the desired value of W/F.

degree of conversion. Thus—although this case is slightly more complicated than the isothermal case—there is no need for a trial-and-error solution.

The nonisothermal, nonadiabatic reaction is the most difficult to calculate. The temperature changes continually as the reaction proceeds, thus changing the values of the constants. However, there are two factors that contribute to temperature change: the heat of reaction and the amount of heat transferred through the walls of the reactor.

Although a relation between the heat of reaction and conversion is known, such a relation for heat transfer cannot be known because there is no way of relating the reactor wall area with conversion. If we had such a relation, we would have the answer to our problem before we started it.

For this reason, the nonisothermal, nonadiabatic reactor cannot be calculated by direct methods. A trial-and-error solution will be required.

Our Method of Presentation

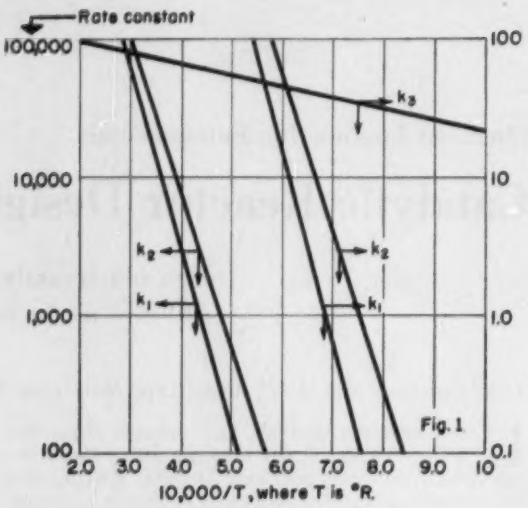
We will try to present illustrative problems on catalytic reactor design with the least amount of confusion. The isothermal case will be presented first because it is the simplest. The adiabatic case will follow next because it represents the next stage of complication. Thus we will build up gradually to the nonisothermal, nonadiabatic case which is by far the most important, since it represents almost all industrial reactors.

In presenting these problems we will emphasize only the kinetic aspects. We don't want to confuse the issue with complicated thermochemical or thermodynamic calculations. We plan to avoid these calculations by using many simplifying assumptions such as constant heat capacities of gases and hypothetical reactions and reactants.

Nomenclature (Consistent Units)

A, B	Reactants
F	Feed rate
k_1, etc.	Rate constant, forward reaction
K_A, etc.	Adsorption equilibrium constant
p_A, etc.	Equilibrium partial pressure of adsorbent gas
r	Reaction rate
R, S	Products
W	Mass of catalyst
x	Degree of conversion

1 Get your k values here.



Design Problem: Isothermal Reactor

Let's consider that the hypothetical reaction

$$A + B \rightleftarrows R + S$$

is a vapor-phase reaction taking place on a solid catalyst. Previous experimental work has established that the empirical rate equation

$$r = \frac{k_1 p_A p_B}{1 + k_2 p_A + k_3 p_R}$$

is sufficiently reliable for design purposes.

If the above reaction is carried out in a longitudinal fixed-bed reactor (operating isothermally) at 1,000 F., what amount of catalyst will be required to cause the reaction to be 95% complete using a stoichiometric feed ratio and no recycle? The desired production rate is 1,000 lb. of R/hr. The reactor is to be operated at 2.0 atm. and has a negligible pressure drop.

Step-by-Step Procedure

Here is the general procedure to use in this type of problem:

1. Evaluate or look up the values of the constants k_1, k_2 and k_3 at the reaction temperature.
2. Calculate the values of p_A and p_R for various values of x from 0 to 0.95 using a material balance.

2 **Solve this equation to get the reaction rate, r:**

$$r = \frac{k_1 p_A p_B}{1 + k_2 p_A + k_3 p_B}$$

where $k_1 = 0.595$, $k_2 = 4.46$, $k_3 = 41.65$

3 **Calculate and tabulate values of r for each value of conversion, x.**

x (p_B)	$1 - x$ (p_A, p_B)	$p_A p_B$	$k_1 p_A p_B$	$k_2 p_A$	$k_3 p_B$	$1 + k_2 p_A + k_3 p_B$	r	$1/r$	Segment Area	Total Area
0.1	0.9	0.81	0.482	4.01	4.165	9.175	0.0524	19.05	.....	.....
0.2	0.8	0.64	0.381	3.57	8.340	12.91	0.0295	33.85	.....	.....
0.3	0.7	0.49	0.291	3.12	12.50	16.62	0.0175	57.10	3.0	3.0
0.4	0.6	0.36	0.214	2.68	16.65	20.33	0.0106	94.90	11.0	14.0
0.5	0.5	0.25	0.149	2.23	20.80	24.03	0.0062	161.5	12.5	26.5
0.6	0.4	0.16	0.0952	1.785	24.98	27.77	0.0034	291.5	22.0	48.5
0.7	0.3	0.09	0.0535	1.340	29.15	31.49	0.0017	588.0	41.0	89.5
0.8	0.2	0.04	0.0238	0.890	33.25	35.14	6.8×10^{-4}	1,475	89.8	179.3
0.9	0.1	0.01	0.00595	0.446	37.42	38.87	1.5×10^{-4}	6,530	255	434
0.92	0.08	0.0064	0.00381	0.357	38.25	39.61	9.6×10^{-5}	10,400	164	518
0.94	0.06	0.0036	0.00214	0.268	39.15	40.42	5.3×10^{-5}	18,900	272	870
0.95	0.05	0.0025	0.00149	0.223	39.60	40.88	3.6×10^{-5}	27,400	224	1,094

3. Calculate the value of r at each value of x.
4. Plot $1/r$ versus x.
5. Take the area under the curve of $1/r$ vs. x from $x = 0$ to $x = 0.95$ (the direct conversion).
6. This area is the desired value of W/F where F is the feed rate and W is the required weight of catalyst for 95% conversion. Since F is known, calculate W.

Let's Work It Out

Using the procedure as outlined above, let's work out the problem that we have been given. Assume that the molecular weights are given as follows: $A = 80$; $B = 20$; $R = 40$; and $S = 60$.

We will obtain values for the rate constants by picking them off Fig. 1 above. The values are: $k_1 = 0.595$; $k_2 = 4.46$; and $k_3 = 41.65$. In arriving at these values we have taken W as lb. of catalyst, F expressed as lb. moles of total feed/hr., and partial pressures are in atmospheres.

Our next job is to evaluate p_A, p_B, p_R and p_S as functions of conversion, x, where x is equal to lb. moles converted per lb. mole in the feed. Then,

Lb. moles of A left $= 1 - x$
Lb. moles of B left $= 1 - x$
Lb. moles of R formed $= x$

On this basis we can work out a table of values for partial pressures.

Component	Lb. Moles	Mole Fraction	Partial Pressure at 2.0 Atm.
A	$1 - x$	$(1 - x)/2$	$1 - x$
B	$1 - x$	$(1 - x)/2$	$1 - x$
R	x	$x/2$	x
S	x	$x/2$	x

Then Get the Rate

When we have arrived at the partial pressure values, we can calculate the values of reaction rate, r, and values of $1/r$ for various degrees of conversion, x. We have done this in the table at the top of this page.

Next, we plot the tabular values of $1/r$ against values of x. Because of the sharp decrease in reaction rate as we go above 80% conversion, it will be convenient to use a two-part plot. First we'll plot $1/r$ vs. x up to 80% conversion (Fig. 2). Then we'll use another plot with a compressed $1/r$ scale from 80 to 95% conversion (Fig. 3).

In any event, we arrive at the total area under the curve.

$$\text{Total Area} = \int_0^{0.95} dx/r$$

Total Area = 1,094

How Many Pounds of Catalyst?

The total area under the curve tells us that we need 1,094 lb. of catalyst per lb. mole of A in the feed to the reactor.

Our desired production capacity is 1,000 lb. of R/hr. With a molecular weight of 40, this would be 25 lb. moles of R/hr. The lb. moles of A required would be:

25 lb. moles of R/0.95 conversion = 26.3

And the weight of catalyst required would be:

$$W = 1{,}094(26.3) = 28{,}900 \text{ lb.}$$

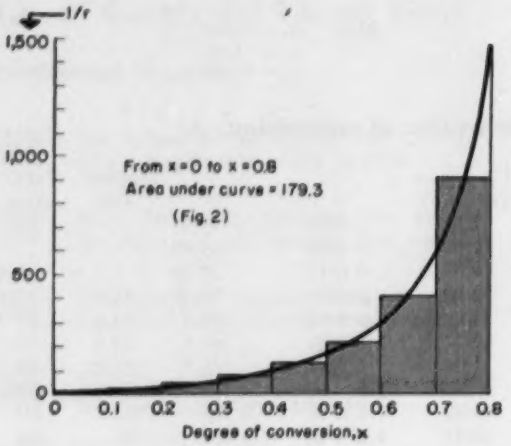
The specific bulk density of the catalyst might be of the order of magnitude of 1.25. Then the volume of catalyst required would be:

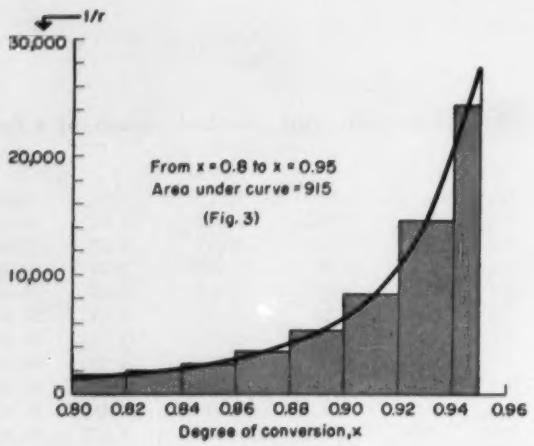
$$28{,}900/(1.25)(62.4) = 371 \text{ cu. ft.}$$

Sizing the Reactor

Let's see what size reactor this volume of catalyst might lead us to. Assume that the reactor is to

4 **Plot $1/r$ vs. x** . . . **For more accuracy use two plots.**





5 **Integrate for total area. Total area $= W/F$.**

ANSWER: $W/F = 1{,}094$

consist of parallel tubes 40-ft. long (I.P.S.). Cross-sectional area of Schedule 40 pipe is 12.7 sq. in. or 0.0883 sq. ft. The volume of catalyst in each tube would be $40(0.0883) = 3.53$ cu. ft.

Therefore, the number of tubes required would be 371/3.53 or 105 tubes. To find the size of the reactor shell we will take the nearest standard tube layout. Referring to p. 842 of "Process Heat Transfer," by D. Q. Kern, we find that for ¾-in. tubes on 1¼-in. centers arranged with a standard triangular pitch (125% of the tube diameter) the shell diameter would be 12 in.

Since we are using 4-in. std. pipe (which is 4.5-in. O.D.) the required I.D. of the reactor would be 72 in.

Compare This With Backmixing

If we were to operate the reactor with the catalyst in one single bed of large diameter and shallow height, there would be considerable backmixing. Let's calculate the amount of catalyst that would be required if the reaction were to take place with 100% backmixing. We can use this equation:

$$W/F = \int_0^{x_f} dx/r_f = x_f/r_f$$

where x_f and r_f are the values of x and r at the desired conversion of 95% ($x_f = 0.95$).

$$r_f = \frac{k_1 p_A p_R}{1 + k_2 p_A + k_3 p_R}$$

At $x = 0.95$,

$$p_A = 0.05$$
$$p_R = 0.95$$
$$k_1 p_A p_R = 0.00149$$
$$k_2 p_A = 0.223$$
$$k_3 p_R = 39.60$$
$$1 + k_2 p_A + k_3 p_R = 40.88$$
$$r_f = 3.64 \times 10^{-4}$$
$$1/r_f = 27{,}400$$
$$W/F = x_f/r_f = 0.95(27{,}400)$$

$W/F = 26{,}000$ lb. of catalyst/lb. mole of A fed to the reactor per hr.

Therefore, the weight of catalyst would be:

$$(26{,}000)(26.3) = 684{,}000 \text{ lb.}$$

This is almost 24 times the catalyst that we needed for the longitudinal reactor.

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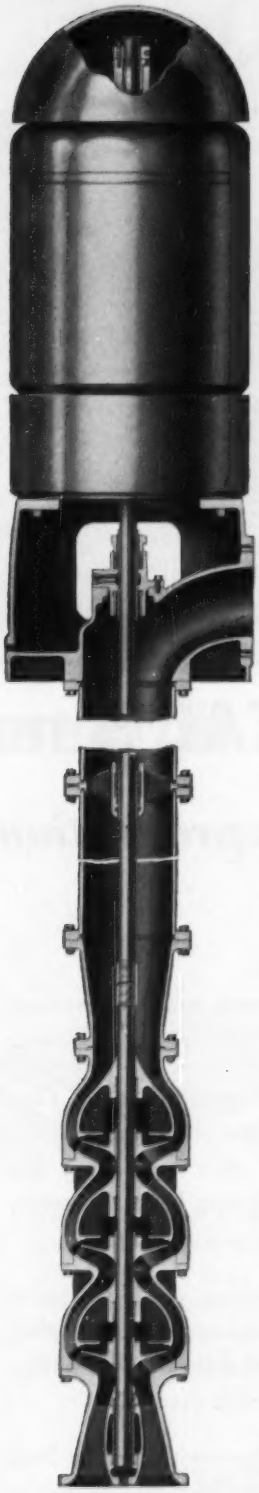

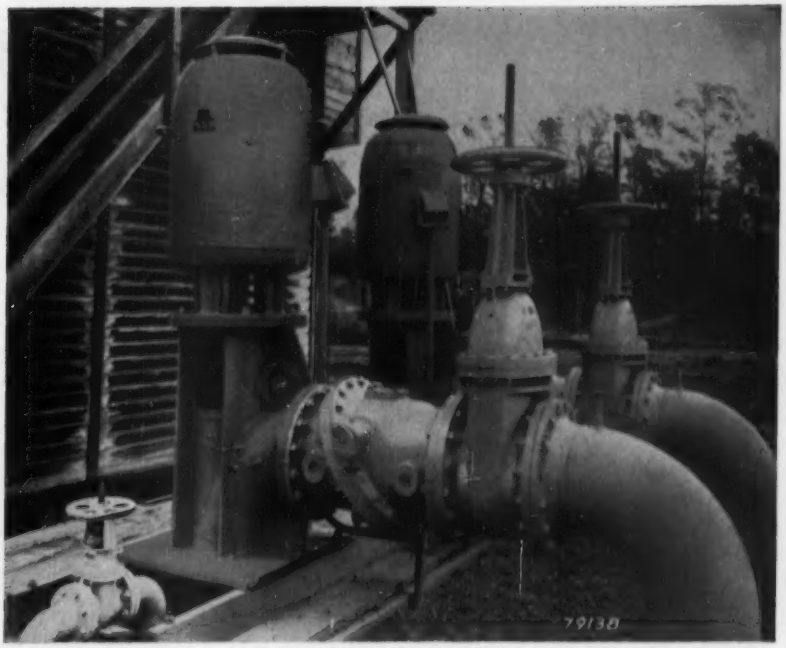

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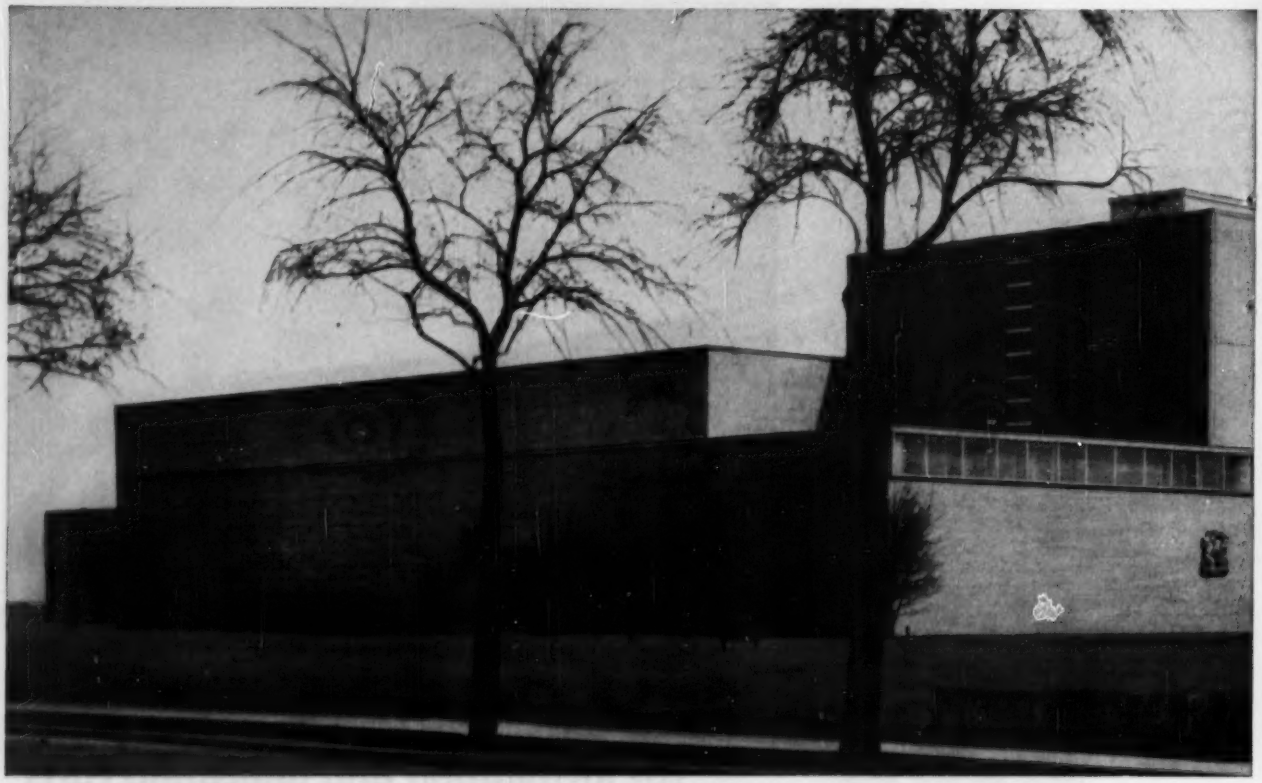

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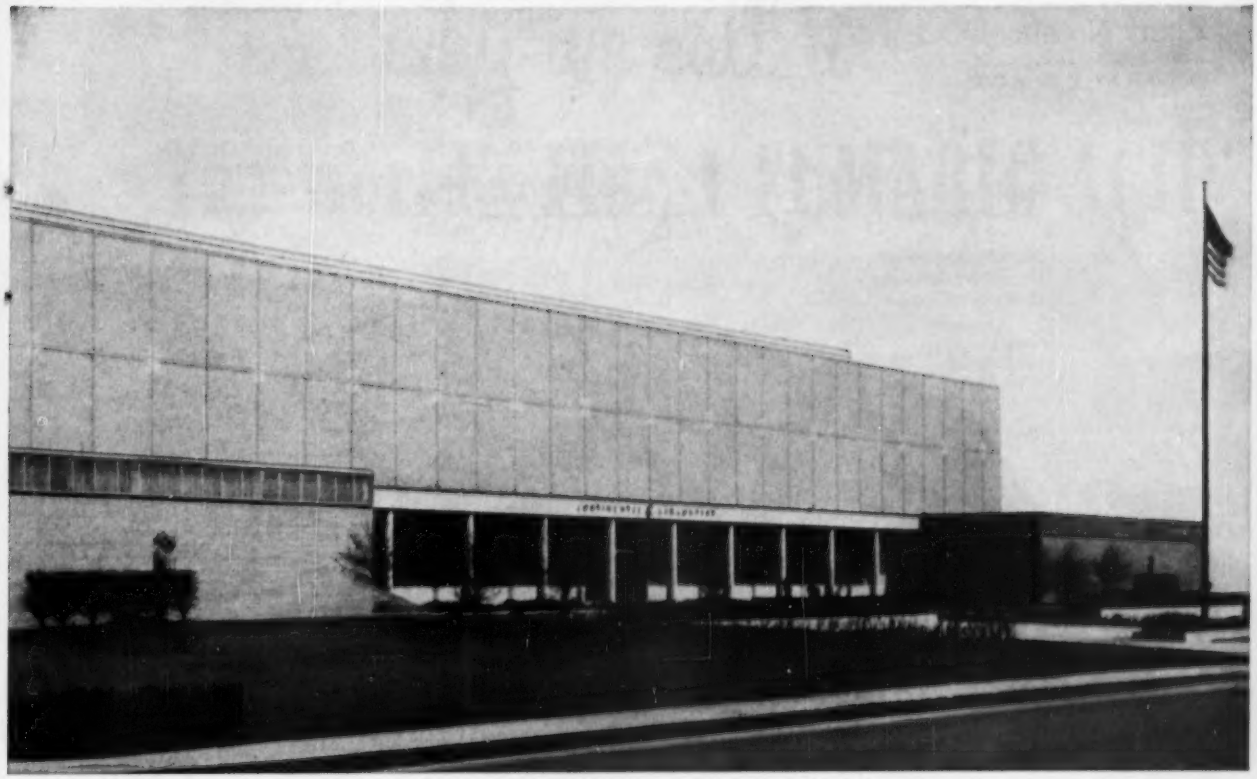

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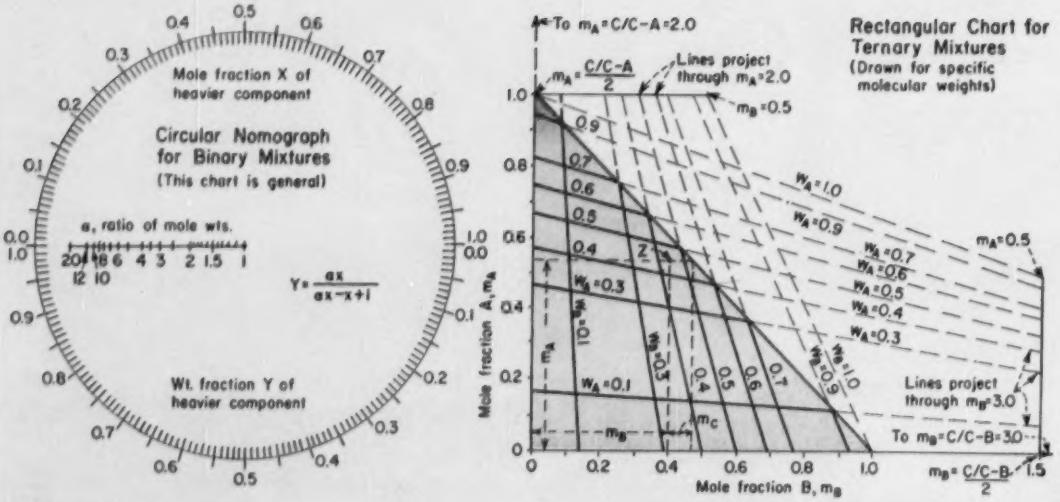
Mole fraction X of heavier component
Circular Nomograph for Binary Mixtures
(This chart is general)
α, ratio of mole wts.
Wt. fraction Y of heavier component
Rectangular Chart for Ternary Mixtures
(Drawn for specific molecular weights)
Lines project through m_A=2.0
Lines project through m_B=3.0
Mole fraction A, m_A
Mole fraction B, m_B

★ **Winner of April Contest**

Ternary Mixture Chart Finds Weight and Mole Fractions

You can inter-convert weight fractions and mole fractions with an easily made chart for mixtures of three materials.

Gerald A. Lessells

Development Dept., Olin-Mathieson Chemical Corp., Brandenburg, Ky.

A number of different charts and nomographs have been developed for the inter-conversion of weight fractions and mole fractions of binary mixtures. So far as I know, however, comparable calculation aids have not previously been brought out for ternary mixtures.* A comparable nomograph for this purpose would consist of a spherical surface and a plane scale with two molecular weight ratios (α's) inside the sphere's surface—certainly an impractical arrangement.

However, by an adaptation of the method of plotting a ternary diagram on rectangular coordinates, I have devised a simple way of drawing up such a chart. Unfortunately, it is not general, but must be drawn for each particular set of molecular weights; still, this is not difficult if the circular nomograph at the left above is used to eliminate calculation of the plotted points. The circular nomograph is adapted from Colton's elliptical chart (*Chem. Eng.*, p. 216, May 1954) which was used to solve the equation $Y = \alpha X/(\alpha X - X + 1)$ for weight fraction-mole fraction conversions for binary mixtures. Here Y = weight fraction and X = mole fraction of the heavier component, while α = ratio of heavier to lighter molecular weight.

Despite the need to draw up a chart for each ternary system studied, this method can save many tedious hours of calcula-

* However, several methods involving complicated geometric constructions have been disclosed for this purpose. See, for example, *Ind. Eng. Chem.*, Apr. 1943, p. 495 and 497, and July 1942, p. 872.

★ **Winner of May Contest—Herbert Borsvold**

"Simple Timer Integrates Gas Flow"

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tion in making the necessary conversions.

Ternary mixtures are occasionally plotted on rectangular coordinates, a method which lends itself readily to the type of construction developed here. It can readily be shown geometrically that the sum of the x- and y-coordinates of a point plotted within a right triangle, to which is added the horizontal or vertical distance of the point from the hypotenuse, is equal to the length of one side of the triangle.

This being the case, if the sides are calibrated as mole fractions from 0 to 1.0, then a point plotted as the intersection of the mole fractions of two of the compounds in the mixture will lie at a vertical or horizontal distance from the hypotenuse equal to the mole fraction of the third compound (since the sum of the three mole fractions must be 1.0).

Assume a ternary mixture, the components of which have molecular weights of A, B and C, with A the lowest and C the highest molecular weight. Let $m_{A,B,C}$ equal the mole fractions of A, B or C, and $w_{A,B,C}$ equal the weight fractions of A, B or C. Knowing the weight or mole fractions of any two components, the third can be obtained by difference, since the sum of all three must equal 1.0.

The triangular chart is constructed by drawing two families of lines, one for the binary system A-C and the other for the binary system B-C. For the first set, the lines are drawn for constant values of w_A, and for the second set, for constant values of w_B. For our example, let the three molecular weights be $A = 60$, $B = 80$ and $C = 120$. For each of the two binary systems we shall assume values of the weight fraction of the lighter component and from them by difference find the corresponding weight fractions of the heavier component. From these, with the aid of the circular nomograph, we then find the corresponding mole fractions of the heavier component, and hence the mole fractions of the lighter component. These are tabulated for several values of w_A for the system A-C, and for several values of w_B for the system B-C as

Construction Points for Diagram

System A-C; $\alpha = C/A = 2$; $C/(C-A) = 2$

w_A	w_C	m_C	m_A	$m_A/2$
0.1	0.9	0.83	0.17	0.08
0.3	0.7	0.54	0.46	0.23
0.4	0.6	0.43	0.57	0.285
0.5	0.5	0.33	0.67	0.335
0.6	0.4	0.25	0.75	0.375
0.7	0.3	0.18	0.82	0.41
0.9	0.1	0.06	0.94	0.47

System B-C; $\alpha = C/B = 1.5$; $C/(C-B) = 3$

w_B	w_C	m_C	m_A	$m_A/2$
0.1	0.9	0.86	0.14	0.07
0.3	0.7	0.61	0.39	0.195
0.4	0.6	0.50	0.50	0.25
0.5	0.5	0.40	0.60	0.30
0.6	0.4	0.31	0.69	0.345
0.7	0.3	0.23	0.77	0.385
0.9	0.1	0.07	0.93	0.465

shown. In making up an actual chart, families of lines for w-values ranging from 0 to 1.0 in increments of 0.05 can be drawn up in less than an hour for the entire job.

To draw in the w-lines it is first necessary to locate an m-value on each of the axes through which the lines can be drawn to the appropriate m-values on the opposite axis. On the m_B axis this point is $m_B = C/(C - B)$, or 3.0 for the molecular weights chosen. On the m_A axis the point is $m_A = C/(C - A)$, or 2.0 for the molecular weights in our problem. These points have no physical significance except as construction points.

Depending on the relative sizes of C and the other two molecular weights, the values of $C/(C - A)$ and $C/(C - B)$ may become too large to keep on the paper. In that case, the construction shown here can be used, although it is somewhat easier to preserve accuracy if the two families of lines are actually drawn through the $C/(C - A)$ and $C/(C - B)$ points. Here we have drawn lines through $m_A = C/2(C - A) = 1.0$, and through $m_B = C/2(C - B) = 1.5$. By making the length of these lines equal to $m_A = m_B = 0.5$, and laying off distances of half the corresponding m-values (as shown in the table), then the w-lines can be drawn through these half-points and the corresponding m-values just as if the construction points at $C/(C - A)$ and $C/(C - B)$ had been used.

Referring to the table, let us plot the line for $w_A = 0.1$. Note that we found the corresponding value of m_A to be 0.17, and the value of $m_A/2$ to be 0.085. The line for $w_A = 0.1$ is then drawn through 0.17 on the m_A axis, and 0.085 on the auxiliary construction axis at the right of the chart. Similarly, to plot the line for $w_B = 0.3$, the line goes through 0.39 on the m_B axis, and 0.195 on the auxiliary construction axis at the top of the chart.

Once the chart has been completed it is merely necessary to locate the intersection of the known values of w_A and w_B (or interpolate between the lines). For example, point Z on the chart marks the intersection of $w_A = 0.45$ and $w_B = 0.45$. Reading to the coordinates, we find $m_A = 0.54$ and $m_B = 0.40$. Their sum equals 0.94, so that $m_C = 0.06$, which corresponds to the horizontal distance from Z to the hypotenuse. Conversely, by entering the chart from known values of m_A and m_B on the coordinate axes, point Z can be located and the corresponding values of w_A and w_B found in relation to the w-lines.

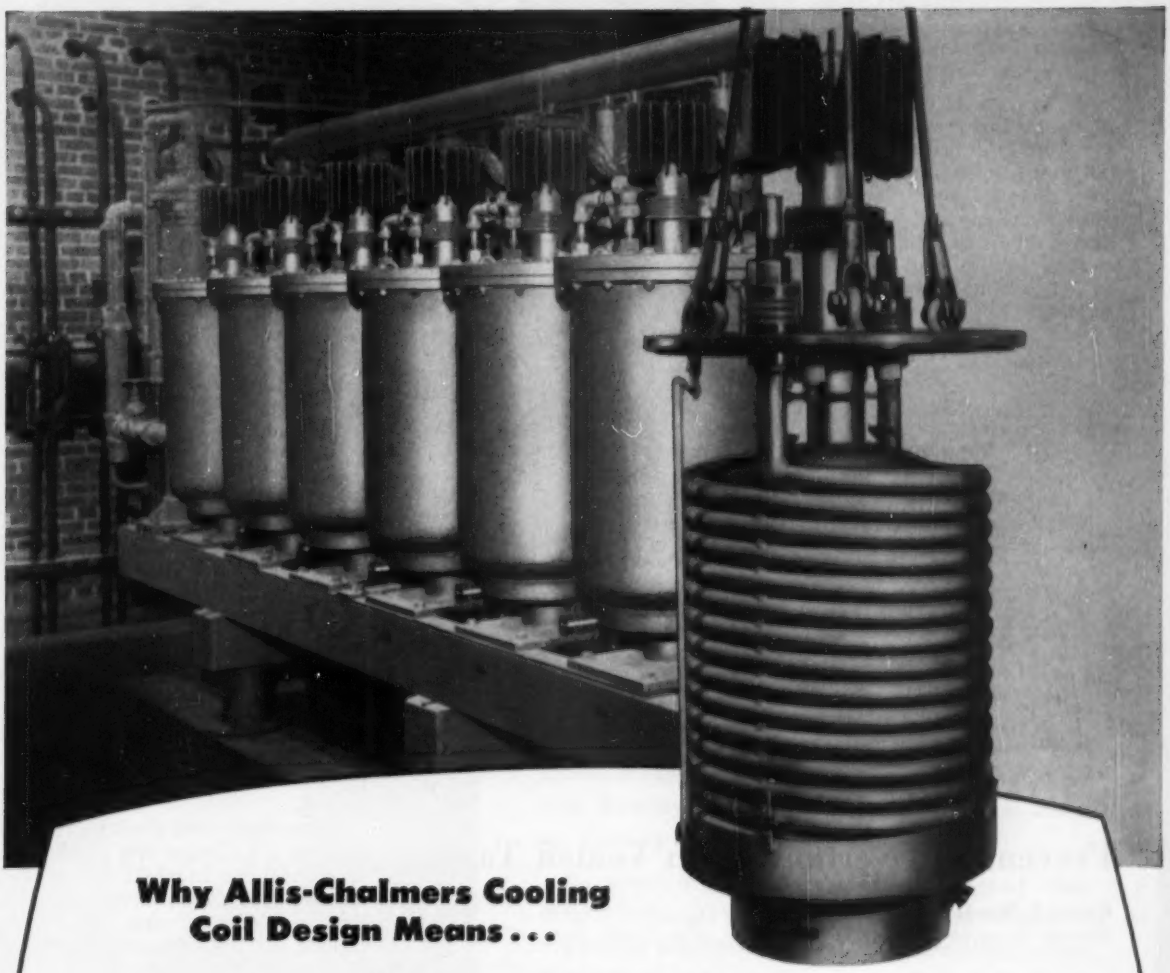
Irregular Areas Found Without a Planimeter

Charles A. Harper

Materials Engineer, Westinghouse Electric Corp., Baltimore, Md.

Often the engineer wants to find the area of an irregular plane geometric surface, but has no planimeter available. Usual methods such as applying Simpson's rule or dividing the area into small squares and counting them, are time consuming. If a sensitive balance is on hand, the easiest and quickest method is to trace the irregular area onto a piece of very uniform material such as paper or tracing cloth, cut it out carefully, and weigh it in comparison with a cut-out of a known area.

The unknown area may be the area under a curve which it is desired to integrate between limits. Or it may be the area of an irregular plane object or piece of material. If it is an irregular piece of material, then a regular piece of the same material can be cut out and weighed. The regular surface should be as



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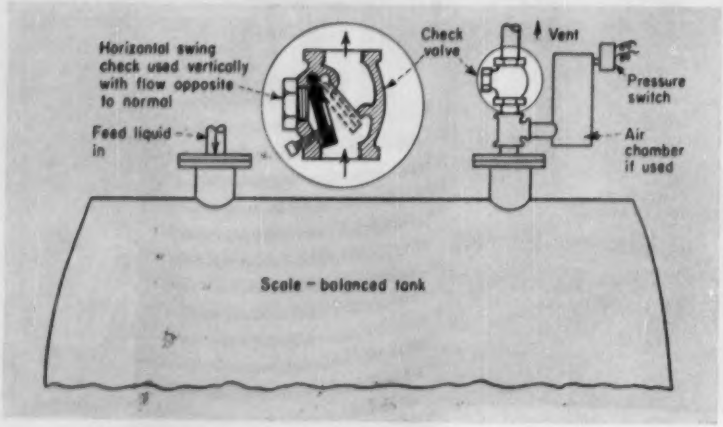
large as possible to increase the accuracy. But if no more of the same material is available, then the unknown area must be traced onto some uniform material as above for comparison with a known area of the same material.

This method can be adapted to determining any area which can be transposed onto a flat surface. It can also be used for volume determinations where a known and an unknown volume can be cut from the same uniform material. It is, in short, useful for any irregular variables which can be calculated as a function of weight ratios.



Preventing Overflow From Vented Tanks

George E. Woods
Central Research Lab., Atlas Powder Co., New Castle, Del.

By means of a simple idea described here overflow and possible loss of valuable liquid from vented tanks can be prevented with safety and certainty.

A certain batchwise reaction required the operator at one point during the reaction period to pump one reactant for a subsequent batch from a remote storage tank to a closed, vented scale tank. An overflow line back to storage was impractical and the operator, busy with other details during the pumping, sometimes forgot to stop the pump in time, allowing profits to flow to the sewer.

The problem was solved by installing a horizontal, swing check valve in a vertical position in the scale tank vent line as indicated in the sketch. It will be noted that the valve disk as installed normally hung in the open position. When the liquid reactant was first pumped into the tank the air in the tank was displaced through the check valve in a direction opposite to that of the designed flow for the valve. This was possible because the kinetic energy of the displaced air was not enough to close the valve from the full-open position. However, as soon as the liquid reached the check valve the valve closed immediately with a mild "snap" which never failed to remind the operator to stop the pump at once.

In every case where the foregoing idea was employed, very satisfactory results were obtained by using a check valve of the same nominal size as the vent line. However, if the valve had closed during the air-displacement period, then at least a section of the vent line and the check valve would have had to be made large enough to decrease the kinetic energy of the gas stream to a point where the gas flow could not close the check valve. If the liquid had failed to close the valve a smaller valve would have been required.

With this system one should use a pressure-relief valve and a circulating line around the pump, or other suitable pressure-controlling arrangement, to prevent pressure in the tank from exceeding a safe value for the particular system involved. In some cases it may be desirable to intall a small vertical air chamber on the tank side of the check valve to minimize water hammer.

This idea may be used without depending on an operator for appropriate action. The pressure at the top of the scale tank rises suddenly when the check valve closes. Hence, the pump may be stopped by means of a pressure-actuated pump cut-off switch. Use of such a switch may be desirable in any case, or in conjunction with an automatic weight-actuated pump cut-off. If the weight-actuated cut-off should fail, the pressure-actuated cut-off would then stop the pump when the tank had filled completely. Even if both cut-off devices should fail, no liquid would be lost.

Other non-loaded check valves, such as lift checks, ball checks, or vertical checks might be used if installed to close with excessive kinetic energy of flow as described for the horizontal check values.

Gage Glass Improvement For Vacuum Tanks

Arthur J. Weinberger
Chemical Engineer, Bridgeport, Conn.

Conventional tank gage glasses are often unsatisfactory for vacuum service, particularly when using liquids which attack the soft washers used in sealing the glass to the gage cock. Air leakage at the bottom washer will make it difficult to tell liquid level, and a large air leak at the top of the glass may go undetected.

We have overcome the problem by using a piece of ½ or ¾-in. glass pipe with conical ends as our gage glass. This is attached by regular glass pipe flanges to metal pipe which makes up the remainder of the gage glass installation. Gate valves are used on both top and bottom legs to

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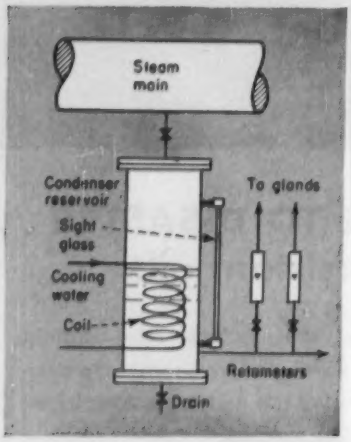
shut off the glass in case of breakage.

It is also wise to use a short section of flexible hose or tubing between the gage glass and the bottom tank tap. This will simplify installation, and will also take up differential expansion of the tank and glass if hot or cold liquids are used in the tank.



Improved Condenser for Supplying Gland Water

R. W. Fugler
Tar Div., Dominion Tar & Chemical Co., Ltd., Toronto, Ont., Canada.

Some years ago I had occasion to use steam condensate for sealing several agitator glands. The principle was the same as that described by the winner of the September 1955 Plant Notebook Contest (also winner of the 1955 annual contest—*Ed.*)

However, our method possessed an advantage which automatically regulated the quantity of condensate produced. This is desirable for a single unit and necessary for several glands.

The arrangement, shown in the sketch, uses a combined reservoir and condenser made of 8-in. pipe. Cooling is provided by a copper coil in the lower half of the reservoir through which cooling water is circulated. The advantage of this arrangement is that, when the reservoir is less than half full, the coil is exposed so as to condense more steam.

However, when the reservoir is half full, then the cooling surface is completely covered with condensate and no more steam is condensed. Thus the supply is self-regulating. This eliminates water-logging of the system and loss of pressure. Also, the use of the submerged coil cools the condensate before use.

Special Lenses Change Drawing Proportions

Newell W. Tune
Los Angeles 48, Calif.

Ramey (*Chem. Eng.*, p. 208, Sept. 1955) described a mechanical method of replotting curves to expand or compress one scale as desired. He stated that photographic methods would be useless for this purpose. As a matter of fact, this is not correct as lenses of Cinemascope type prove. Lenses of this type expand the image in one direction by a ratio of about 2:1.

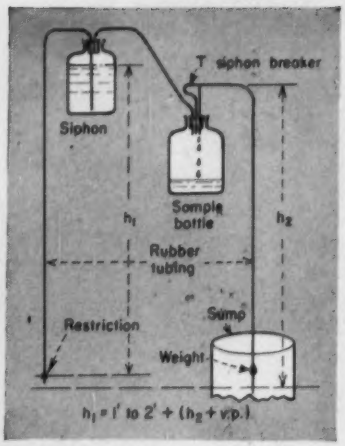
I have used such a lens for about 10 years for special trick effects in 16-mm. motion pictures, and also over a 50 mm. Contax lens to compress or expand the image as desired. My lens was made by Taylor, Hobson, Cooke, in England. One is made in the United States by Vidoscope, another by Vistascope. Any large photodealer can supply literature on them.

Photographic alteration of proportions with such lenses will be much faster, cheaper and more accurate than the replotting method.

Portable Air Compressor Takes Care of Shortages

H. B. Wayne
Brooklyn, N. Y.

If your plant is occasionally short of compressed air capacity, so that increase in the permanent equipment may not be justified, one possible solution is to hook a portable compressor temporarily onto the discharge line. For this purpose flexible metal or rubber hose is handy, particularly if equipped with quick-connect couplings. This arrangement is flexible and can be moved wherever needed.



Siphon Arrangement Takes Continuous Samples

R. E. Calcote
Chemical Engineer, Ethyl Corp., Baton Rouge, La.

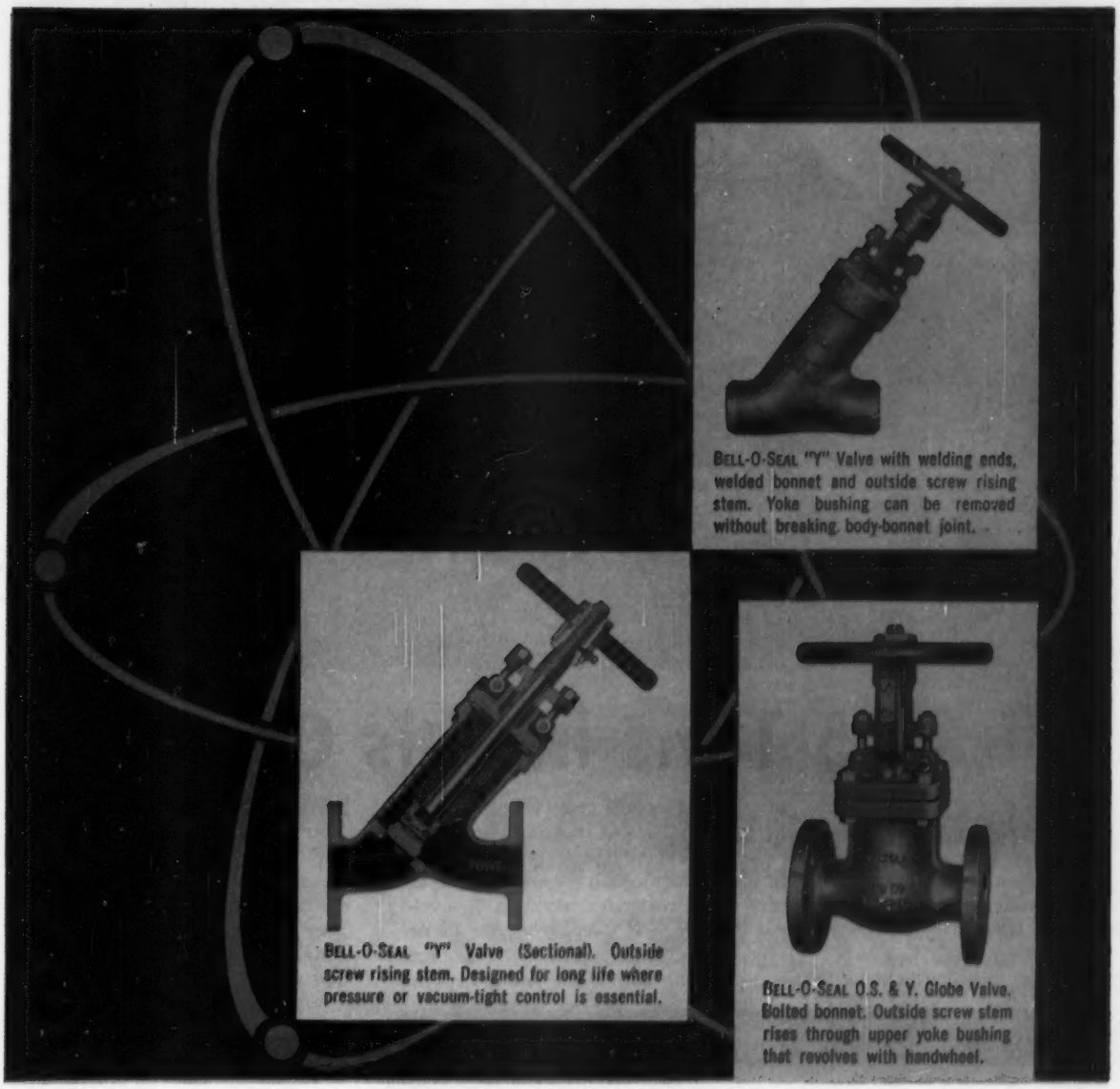
Sometimes plant material balance studies or pollution studies call for an inexpensive continuous sampler. The arrangement in the accompanying drawing has been used successfully in plant waste stream studies to draw samples 10-15 ft. up from sumps, ditches, and other inaccessible locations.

The sampler can be put together easily from a couple of glass jugs of suitable size and some rubber and glass tubing.

The drop line from the siphon bottle is provided with a suitable limiting restriction such as a glass capillary to assure flow for a desired time interval. As the siphon empties, it creates a partial vacuum in the sample bottle which is balanced by ditch water entering the sample bottle. To prevent a siphon cycle which would cause intermittent sampling, the sample bottle must be equipped with a siphon breaker. This consists of a glass tee with two returns to the bottle.

This device will sample as long as the drop h_1 is 1 or 2 ft. greater than the rise h_2, plus the vapor pressure of the sampled fluid in the vapor space. This statement is a simplification of the theoretical factors involved in this fluid flow problem, but it yields a practical solution to many sampling problems.

Powell packless valves for hazardous services



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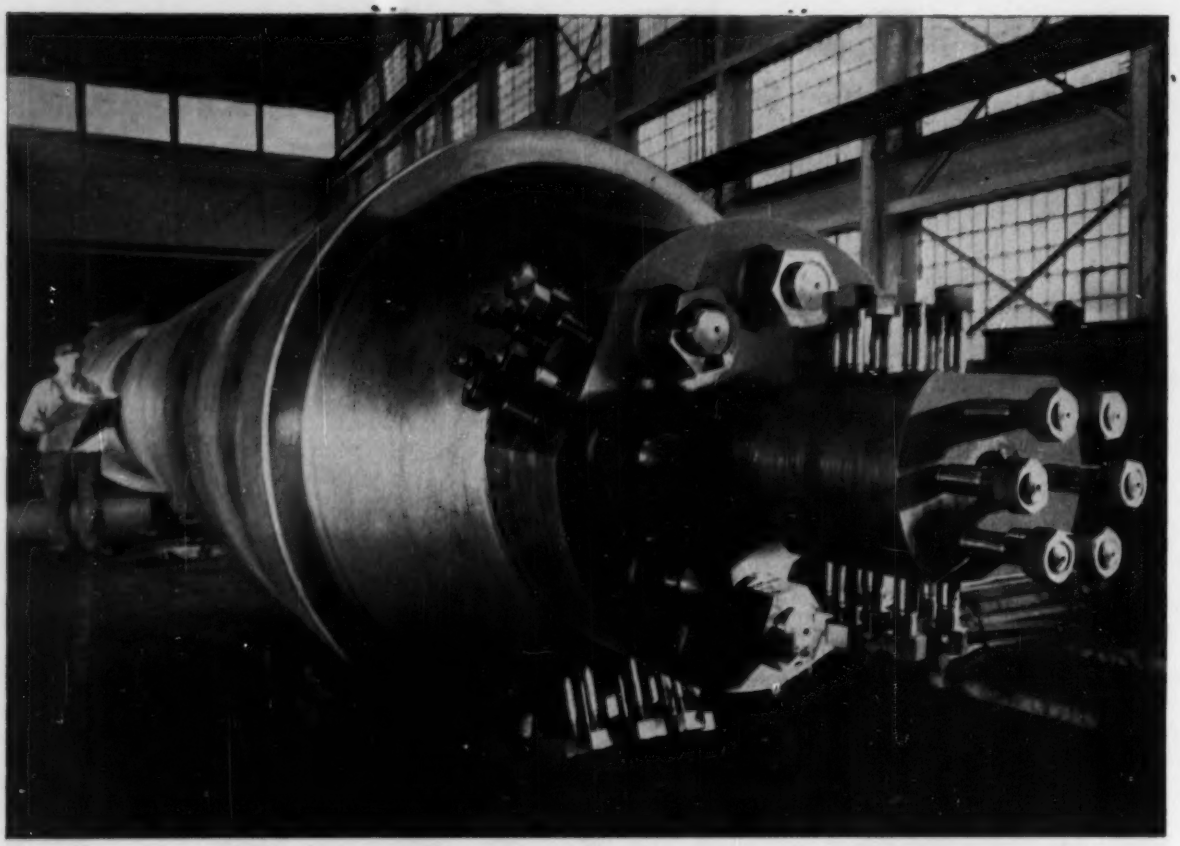

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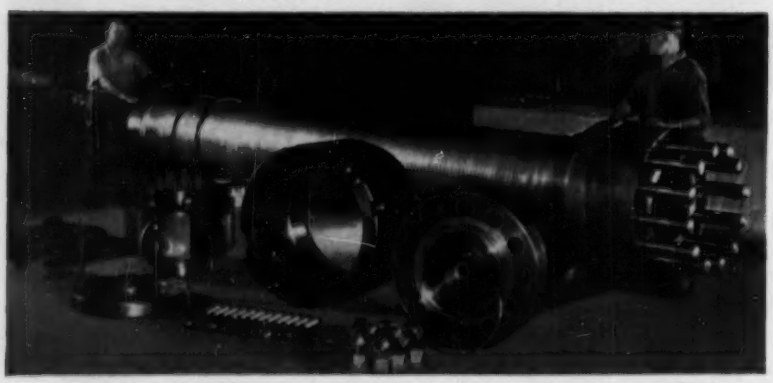

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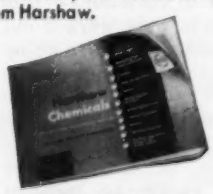

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Here's How to Get an Idea—in a Hurry

- **Follow the creative process.**
- **Practice using it often.**
- **Know what not to do.**

IDEAS, like dollars, are usually hardest to get when they're needed most.

But—unlike the printing of currency—no one has a monopoly on producing good ideas. It's a skill that any chemical engineer, or just about anyone else for that matter, can acquire.

Sure, some people are just naturally better at it than others, but research and experience are showing that virtually anybody can be taught the techniques and attitudes that will boost his idea productivity.

This message has been made the theme of countless articles, books and speeches over the past few years. And numerous studies and experiments have led to the development of systems which increase creativity.

Not the Whole Answer

But, unfortunately, today's methods for upping idea production are mostly empirical. Basic research, which would delve into these methods to learn why they work, and which would lead to better idea-producing tools, lags far behind application. As a result, the use of the trial-and-error-derived systems is not yet the whole answer when you need an idea in a hurry.

Idea production has three interrelated aspects: Quality, quantity and speed.

When creative ideas start flowing, they often come in a flood. One idea seems to spark the development of others and they build on one another. Most systems for increasing creativity recognize this and it's a general rule that "the more ideas, the better."

Follow the Creative Process

You can encourage ideas to flow faster by following through the creative process, using it often and knowing how to avoid the obstacles which are built-in at every step.

The creative process consists of a string of stages leading from recognition of a problem to its solution by a new approach. Many problems are analytical by nature; they don't require a creative approach. Once all the data are obtained only one conclusion is possible.

Other problems have many possible or acceptable solutions and they're often not the kind you can work your way to. They require the new insight, the leap of the imagination, the "brain-flash" which climaxes the creative process.

How Ideas Are Born

The nature of the process which brings ideas to life stirs speculation and controversy among creativity researchers. But while waiting for their studies to develop a more exact description, we can synthesize a working description from those which have been offered.

The process dawns with the recognition of a problem and decision to try to solve it. Then comes a period of preparation, in which you seek a complete understanding of the problem and search your own experience and that of others for relevant information. This information is studied to find clues to the solution of the problem at hand. Solutions are formulated and tested.

Frustration Is Normal

Frustration is a normal experience in this sequence. Some observers call it a vital part of the process and insist that only after you've been completely bogged down in a problem and have actually turned away from it will you get the insight that leads to a new solution.

Final stage of the process concerns putting the idea to work. It must work and it must work better or it isn't a good idea. This should be obvious, but, in practice, much creative activity offers only something different, not necessarily better.

How to Speed It Up

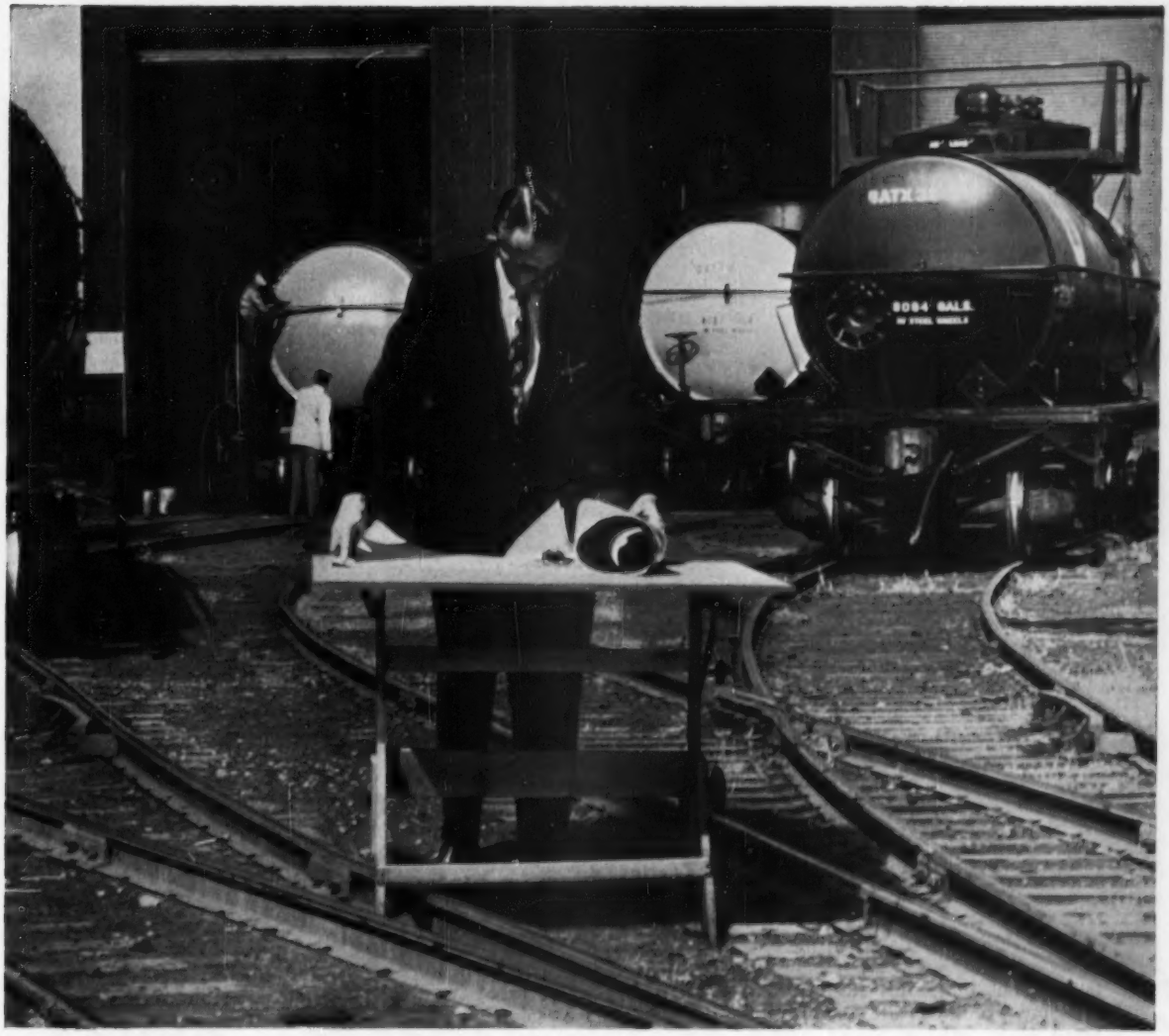
The creative process takes time to operate, how can it be speeded up? Could steps be eliminated or combined? What time wasters can be avoided?

Many workers in this field have been trying to develop definitive answers to these questions and a good many chemical companies have been following this work with interest. (But with few exceptions, companies limit their activities in this field to trying to provide an environment favorable to creativeness. And most of this centers around researchers, not engineers.)

Group idea-getting is a common method of speeding up the process.

The "brainstorming" session, in which five to twelve people engage in uninhibited idea-getting, is today's most popular device for generating ideas in a hurry. In these free-wheeling conferences, ideas (the wilder, the better) ricochet from one person to another and are combined, enhanced or modified with other ideas in the complete absence of criticism. The object is to get as many ideas as possible in a completely free atmosphere. Evaluation and criticism of these ideas take place later.

A number of variations of this technique have been worked out for specific situations. To bring the thinking of a large group of people of all company levels to a problem, Phillips Petroleum developed its Method 66. The large group is broken down into small panels of men of about equal rank in the company



What does an engineer do for GATX?

Engineering a special-purpose tank car is a job for experts. Stress, mobility, center of gravity, corrosion resistance—these are a few of the factors to be considered. At General American you'll find engineering specialists—men who pioneered with aluminum tank cars. These made possible bulk shipments of hard-to-handle liquids. You'll find men who developed the first flued-dome tank car, the first all-welded underframes, the first half-oval heater coils—and a long list of additional improvements.

This engineering skill and experience that make such developments possible is part of every GATX lease—a lease that provides shippers with the most dependable service available for bulk liquid transportation. When you lease cars from General American, you avoid the need for capital investment as well as operating, servicing and maintenance problems.

If you'd like additional information concerning the advantages of a GATX lease, call or write your nearby General American District Office.

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and with widely diverse backgrounds (chemistry, engineering, accounting, law, production, research, sales, etc.). Each panel brainstorms the problem and contributes its one best idea to the over-all group for its consideration and evaluation.

Beware of the Blocks

Attempts to speed up individual creativity have also centered on the free-wheeling, uninhibited approach. John E. Arnold, the MIT professor whose course in creative thinking has attracted worldwide attention, cites three general barriers to this uninhibited thinking.

• Perceptual Blocks — All those things that prevent our getting relevant, adequate, true information. This group of barriers includes: Faulty observation, failure to distinguish between cause and effect, failure to relate the problem to its environment, inability to see the "trivial" and lack of interest in studying the "obvious."

• Cultural Blocks — All the pressures which shape our thinking. Under this heading come: Traditions, training, environment, social and job pressures, resistance to change, etc.

• Emotional Blocks—All fears and phobias, emotions and motivations that limit our creative potential. These are the most basic of the blocks and often lie beneath the others. They include: Jealousies, prejudices, fear of making an error, fear of appearing "out of line," fear of asking questions that show ignorance, compulsions to conform, etc.

How to Skirt Them

To overcome these barriers, Arnold suggests:

• Stating problems in a very basic, broad, generic way—Avoid suggesting a solution in the problem statement. Don't say "Build a better mousetrap." Say "Kill Mice." Don't say "Design a toaster." Say "Design an apparatus for dehydrating and browning the surface of bread." By opening up all possible paths to a solution, you skirt the perceptual blocks.

• Avoiding ready-made solutions—Ask the impertinent questions, insist on full and understandable answers and put a little less faith in reason and logic. Free your imagination and open the way to new answers. Delay judgement of an "impractical" idea until it's been fully explored without prejudice.

• Developing a dual personality—Watch yourself as you solve problems creatively. See what method is successful and what methods fail and learn why. Determine why you picked that route and avoided other areas of thinking. Note how you react to a possible solution and ponder whether an unrecognized block caused the reaction. As you come to know yourself better you'll find creative ideas coming more quickly and easily.

Now as we run through the creative process, we can look for these booby-traps at each step and plot how to avoid tripping over them.

Recognizing the Problem

It usually isn't too difficult to spot problems in industry. But care must always be taken to insure that the problem spotted is the real problem and not just a symptom.

In a division of a well-known chemical company, management is quite concerned with an apparent lack of creativity among its younger engineers. Several quite impressive solutions are under high-level study right now. But none of them will work, because the engineers themselves feel that it's all but impossible to get an idea accepted. They complain that management wants new ideas, alright, but when it comes to using these ideas in a new facility, management generally nixes them with the comment that it "can't afford to take chances." So it sticks to those that "we experienced men know will work." And while striving to make its engineers more creative, this management misses its real problem: How to get more creative ideas into use.

Inability to distinguish between cause and effect and inability to relate a problem to its environment hinder problem recognition and cause a lot of wheel-spinning in the search for solutions. It's important to creative thinking to phrase a problem in terms as broad as possible and not to suggest a solution in the statement of the problem. Always look beyond the immediate problem to its fundamentals.

Deciding to Solve It

With most of the problems you meet in your work you don't have to make an *active* decision to solve them. You either do it or you wind up working elsewhere. But there are other problems which do require such a decision. Perhaps they've been under your nose for years, always looking too hard or too time-consuming or too something-or-other to tackle.

Perhaps it's just the everpresent problem of developing shortcuts in your daily job. Some creative thinking on the obvious or trival aspects of your job may pay off.

Carbide and Carbon's C. H. Gilmour spent years designing all types of heat exchangers. Then he developed a set of charts which cut hours from the job of sizing the units. Published in a series of *Chemical Engineering* articles* they're now saving time for engineers all over the world and have brought a measure of fame to the author.

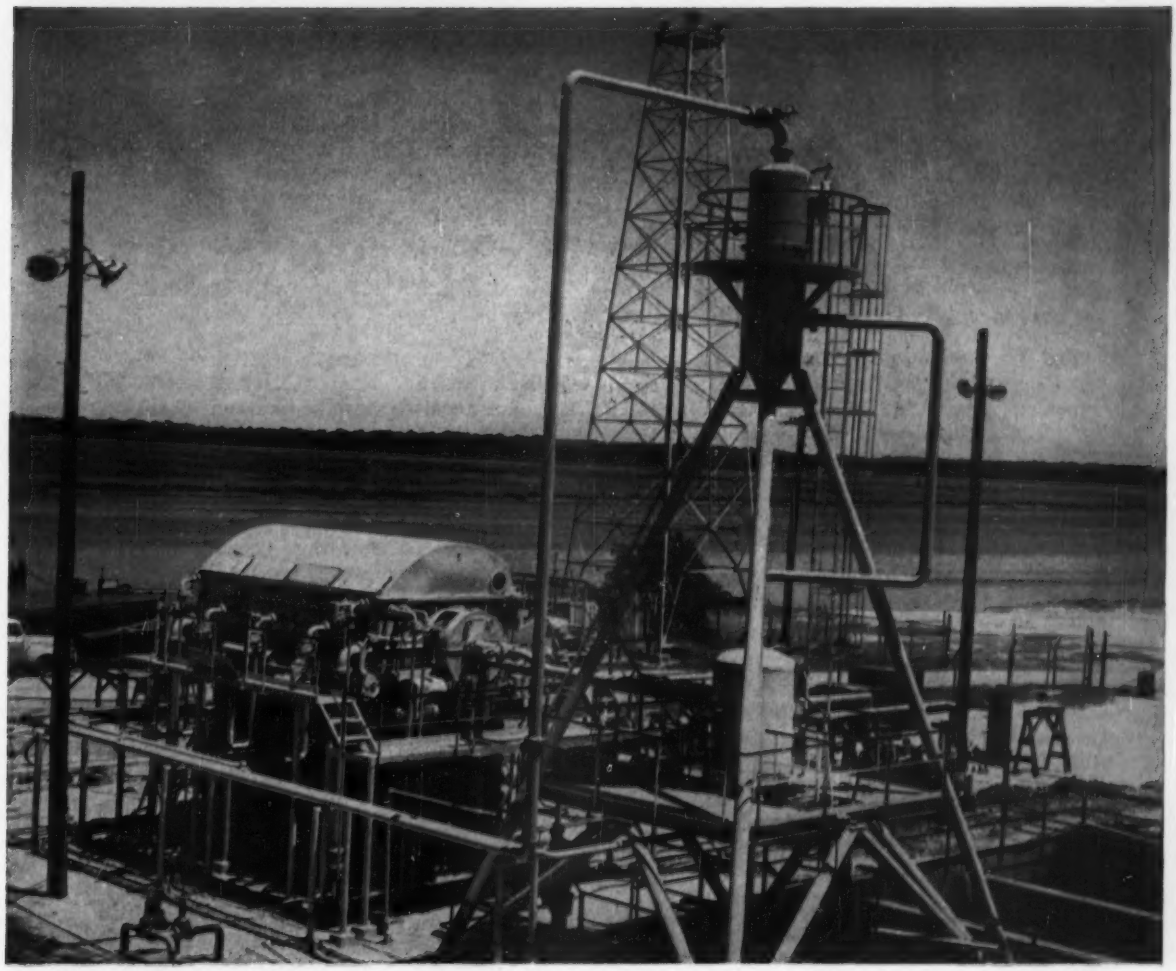
Believe in Yourself

In deciding to tackle a problem, it's important to have confidence in yourself. You'll need it to come up with ideas that run counter to tradition or to man's ingrained resistance to change.

People are generally reluctant to part with things that are familiar—be they methods, products or concepts. Creative people need the confidence to advance unfamiliar ideas. Had they listened to the experts of the day, the Wright brothers would have known that trying to fly was ridiculous and illogical and gone back to doctoring bicycles.

You can build this confidence by scoring a few successes with small problems before tackling the major ones. Creativity isn't limited by age, sex, heredity, education, intelligence or bank account. You have a certain potential for creative thinking. You don't have to apologize for de-

*Chem. Eng., Oct. 1952, p. 144; Mar. 1953, p. 226; Apr. 1953, p. 214; Oct. 1953, p. 203; Feb. 1954, p. 190; Mar. 1954, p. 209; Aug. 1954, p. 199.



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The Eimco Corporation has worked more than half a century to serve the processing industries, providing a background of experience in solving filtration problems which is most valuable to the plant operator. In addition, Eimco's Research and Development Center in Palatine, Illinois is the first complete facilities of its type devoted to liquids-solids separation through filtration.

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B-190

veloping it and for thinking up "unheard of" solutions.

In most firms it won't take too long to find that deciding to solve problems, particularly the unpopular problems that nobody bothers with, will pay off. If it doesn't at your present firm, you'll have no problem peddling your abilities to others.

Hunting New Solutions

A creative idea is essentially a new configuration, a new pattern or a new combination of old information, old experiences. Therefore it makes sense to store up as much information and experience as possible.

Attending conventions and meetings, listening to papers, visiting other plants, lunching or talking to creative people, reading technical magazines, scanning all kinds of reading matter, taking advanced or refresher courses, listening for gripes, watching for and noting the unusual, can all provide sources of information and experience which you can later correlate, evaluate and apply to problems.

Here's where a good statement of the problem first shows its importance. If the statement puts narrow limits on the answer, other, perhaps more profitable, answers, may be ignored.

If you scrimp on the time spent in preparing to solve the problem, the same thing happens. General Electric's Creative Engineering Course teaches engineers to get a minimum of eight possible solutions to every problem. GE reasons that while the first few solution ideas may come with ease, the last couple should require a look into new areas.

Some others recommend getting at least one solution that's chemical in nature, one that's mechanical in nature, one that's electrical and one that's psychological. In this way, it's claimed, each of these major areas of thinking will at least be investigated.

Willard A. Pleuthner, a disciple of advertising man Alex Osborn, who first championed the brainstorming technique,* estimates that the average brainstorm session should generate about 50 ideas of all types and backgrounds—some three to five of which will prove workable.

Keeping Ideas Flowing

Proper preparation starts that flow of ideas; a few simple techniques can keep them flowing.

Creative ideas often come in a flood. Once you break through a barrier and get a new insight into a problem, you start a spurt of uninhibited thinking that may unveil other possibilities. It's been compared to a run of hot hands in poker. And like poker, you dare not leave the game while this is happening. If you do, and try to pick them up later, you're apt to have cooled off like a penguin's tail.

One way to keep ideas flowing involves scheduling your creative thinking periods for those times when you're most creative. If you're a slow starter each day, the kind of fellow who doesn't really get going until early afternoon or so, then do your evaluating and investigating in the morning and reserve one o'clock on for your uninhibited thinking.

It also helps to concentrate. Work on only one problem at a time. If you really get stuck on a problem, drop it completely and do something else. Don't try to juggle two problems at the same time. It doesn't work.

Use "Idea Needlers"

When the idea flow slows, Osborn and Notre Dame University professor G. Herbert True, a widely-known speaker on creativity, recommend the use of what Osborn calls "idea needlers." This is a list of such questions as: What else is like it? Does the past hold a parallel? What other idea does it suggest? Can I modify? Change color, meaning, motion, sound, shape? Can I add to it? Make it bigger, thicker, higher, longer, stronger? Can I subtract? Make it lighter, shorter, break it up, omit it? Can I substitute in it? Can I rearrange it? Can I combine it? Can I reverse it?

Ask these questions of your ideas or the present solution, and you'll probably come up with a hatful of more ideas.

Here's an example:

Most processes for winning manganese from low grade ores shun the electrothermal route because too much of the material is lost in the slag. Inventor Marvin Udy looked at this from the other side. His new process reverses the situation. Udy *maximizes* the manganese in the slag and then treats the slag like a high-grade ore. Now heading for the pilot plant, the process has already attracted the backing of the Reynolds Metals Co.

Cut It Down to Size

If you're still having trouble, whack up your problem into several more digestible pieces. Then you can solve each of these.

When Ottmar Mergenthaler split the problem of designing a typesetting machine into three smaller problems—composing a line, adjusting its length and redistributing the type—and solved each of these in turn, he licked an "impossible" problem.

Two other good ways of speeding the development of ideas are setting deadlines and quotas. Put in writing that you'll have so many ideas on your problem by a certain date. Naturally, you'll jot down your ideas as you get them—not try to remember them—so you'll be able to check them against your quota.

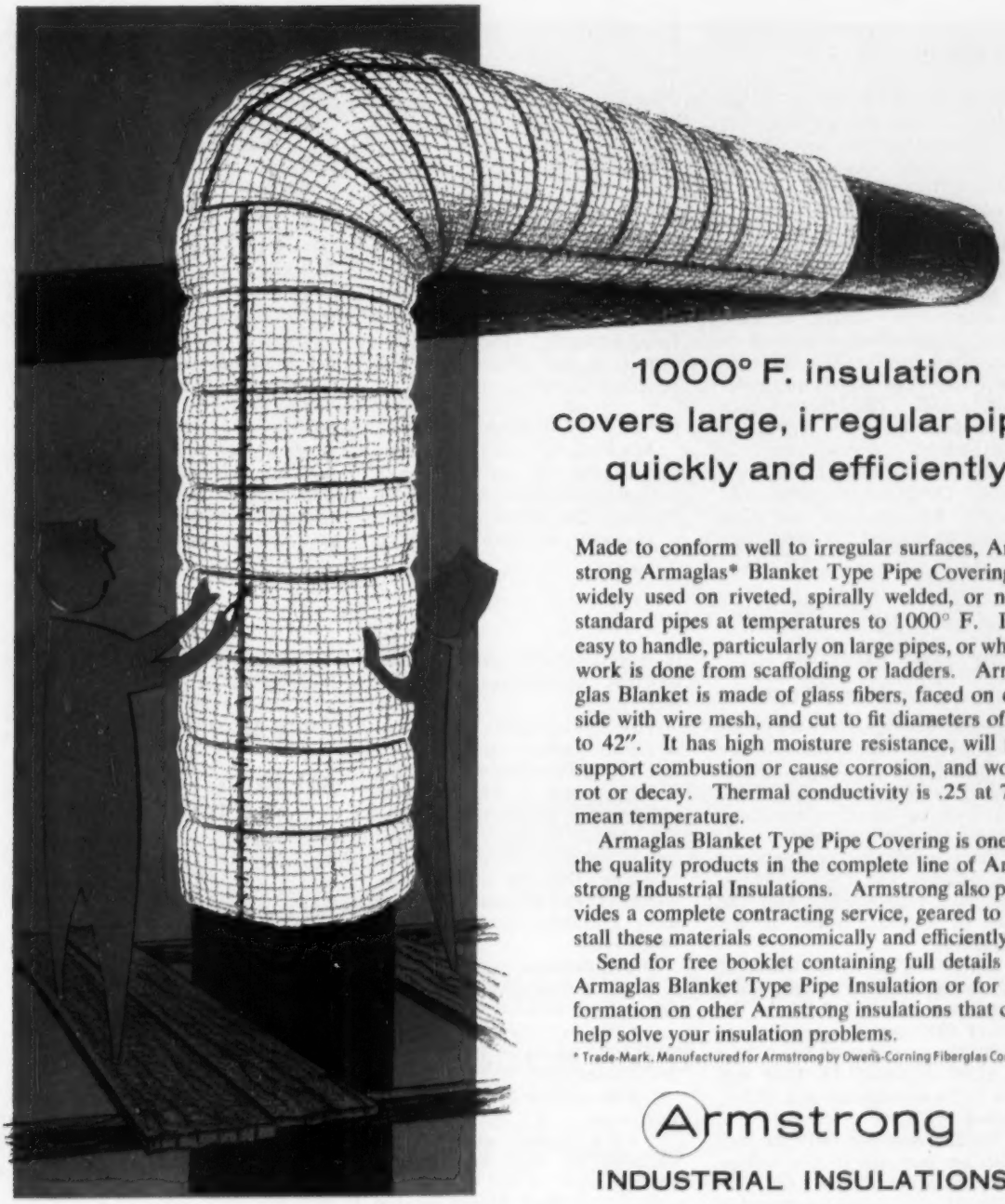
Pleuthner suggests carrying a file card, a new one for each day, and noting all the ideas you have that day on each of the problems you're working on.

Don't forget to get together with associates or other creative people and try brainstorming or

*For a detailed description see Osborn's book, "Applied Imagination," Charles Scribner's Sons, New York, 1953.

Next Month: Career Possibilities in Patent Law

A chemical engineer and patent attorney will open the field of patent law for your inspection in August's You and Your Job. He'll discuss the job opportunities open to you, what they require, what training is needed, how to get it, how long it will take, what the rewards are and other features of careers in this fascinating field. In addition, you'll learn of the shortcuts which lop years off the time usually required to become a patent attorney.



1000° F. insulation covers large, irregular pipes quickly and efficiently

Made to conform well to irregular surfaces, Armstrong Armaglas* Blanket Type Pipe Covering is widely used on riveted, spirally welded, or non-standard pipes at temperatures to 1000° F. It is easy to handle, particularly on large pipes, or where work is done from scaffolding or ladders. Armaglas Blanket is made of glass fibers, faced on one side with wire mesh, and cut to fit diameters of 3″ to 42″. It has high moisture resistance, will not support combustion or cause corrosion, and won't rot or decay. Thermal conductivity is .25 at 75° mean temperature.

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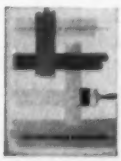

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one of its variations. Only an individual can get an idea, but the stimulation of creative group sessions may provide just the right environment for you to get the idea you need in a hurry.

When All Fails

As we've noted, frustration is a common experience in idea chasing. After hours, or even days, of wrestling with a problem, often feeling that you're on the verge of solving it but never able to pull it off, frustration is understandable. And it's often worthwhile.

About the only thing to do is relax. Drop the problem completely. Ideally, you'd take a vacation, or at least get away from the work. Usually, you'll have to be content with switching to another problem.

While your mind rests—or dwells on other matters—solution ideas have a chance to incubate, to rattle around in your subconscious and come at you from a different angle. This is the idea-getting process called illumination. Ideas seem to come from nowhere, when you least expect them, after conscious thinking has stopped.

Always Make It Work

After you've gone through the process and you have a new and workable idea, don't think you're finished. The difference between a workable idea and a working idea is often a million dollar gap.

As John Arnold puts it: "Ideas can frequently be a dime a dozen. It is only when they've been translated into prototypes that I believe they have value.

"Sometimes we get so enthused about a hundred ideas that we forget that there is a lot of work between the idea and the end result. A lot of bugs have to be worked out. There's polishing and repolishing, working and reworking before you can finally get a patent, before you finally get something that will work, before you finally sell the boss on the idea and he in turn sells the public. The creative process is not completed until you have some tangible result."

FOR THE FUTURE
. . . *More Engineers*

Repeated cries of alarm about the shortage of engineers are being heeded by high school students. More and more of the juke-box set are directing their careers into technology.

Total enrollment in engineering colleges has been climbing the past four years. And the rate of increase itself is accelerating.

According to U. S. Office of Education figures, engineering enrollment climbed 6.6% in the fall of 1952 over the prior year; in 1953 it went up another 9.5%; it climbed 10.9% in 1954 and last fall's enrollment was 13.5% higher.

The increase last fall coincided with an increase in the college age population of only 3.6%. Enrollment in non-engineering courses also climbed, but not as impressively as engineering did.

About one-half of one percent of the total would-be engineers are women.

YOUR JOB TOO BIG?
. . . *Be the Boss*

Ever feel that you aren't quite good enough to hold your present job?

Don't worry. Perhaps you're on your way to becoming president of your company. Such doubts regularly assail key executives in business and industry.

This finding came to light in a recent survey conducted for the Young Presidents' Organization, a group of 950 men and women each of whom took over the reins of a million-dollar (sales volume) business before reaching the age of 40. The survey covered some 600 company presidents and 2,100 key executives.

Other findings:

- A "young president" averages about $41,000 per year.
- His net worth runs about $278,000. About 10% are in the millionaire class.
- He carries $116,000 in life insurance.
- His biggest worry is developing a top management team.

Wall Street Journal

ENGINEERING GROUPS
. . . *Keeping Them Straight*

"Engineering Societies Directory," a listing of all local, regional and national engineering societies, is available from the Engineers Joint Council.

The comprehensive list* contains the name and purpose of each organization, as well as the name and address of its secretary. EJC intends to keep this new service up-to-date by publishing periodic revisions.

* To order, write E. Paul Lange at EJC, 29 West 39th St., New York 18, N. Y. Price $3.50.

SALARIES
. . . *75% Get Raises*

If you're in the so-called "middle management" group,* the odds are three-to-one that you got a raise last year.

According to the American Management Association's latest survey of the total compensation paid to 20,000 executives in 43 key positions in 33 industries, the average middle management man earned $11,347 last year—about 5% more than he received for the year before.

Three-fourths of these executives received raises for one reason or another. Merit raises, ranging from 5% to 9%, went to a third. The others got theirs through a promotion or because of a general increase.

In small companies middle management salaries usually range from $5,000 to $14,000 per year. In large companies, AMA reports, they may top $30,000. Ceilings seems to be related to company sales and profits; legislation and union contracts determine the floors. Other determining factors are specific for each position.

*Jobs between the policy-making level and that of general foreman or first line supervisor.

Enjay Butyl—*today's fabulous rubber* gives new life to backyard wading pools

Enjay Butyl brings long life and performance strength to the sensational new Bil-O-Matic®, rubberized fabric wading pool manufactured by the Bilnor Corporation. With its resistance to aging, sunlight, tear and impact damage, the pool manufactured with Enjay Butyl gives outstanding performance. Unlike other pools that cracked and leaked after exposure to sunlight, these *new* pools retain their durability under even the toughest conditions of wear, stress, and weather. The Enjay Butyl label on the carton assures the customer of exceptional quality.

Extremely versatile, Enjay Butyl has led to improved product performance in a wide variety of fields. This amazing, low-cost rubber is *immediately available* in non-staining grades for white and light-colored applications. To find out where Enjay Butyl can *cut costs* and *improve your product*, contact the Enjay Company. Complete laboratory facilities, fully staffed by trained technicians, are at your service.

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Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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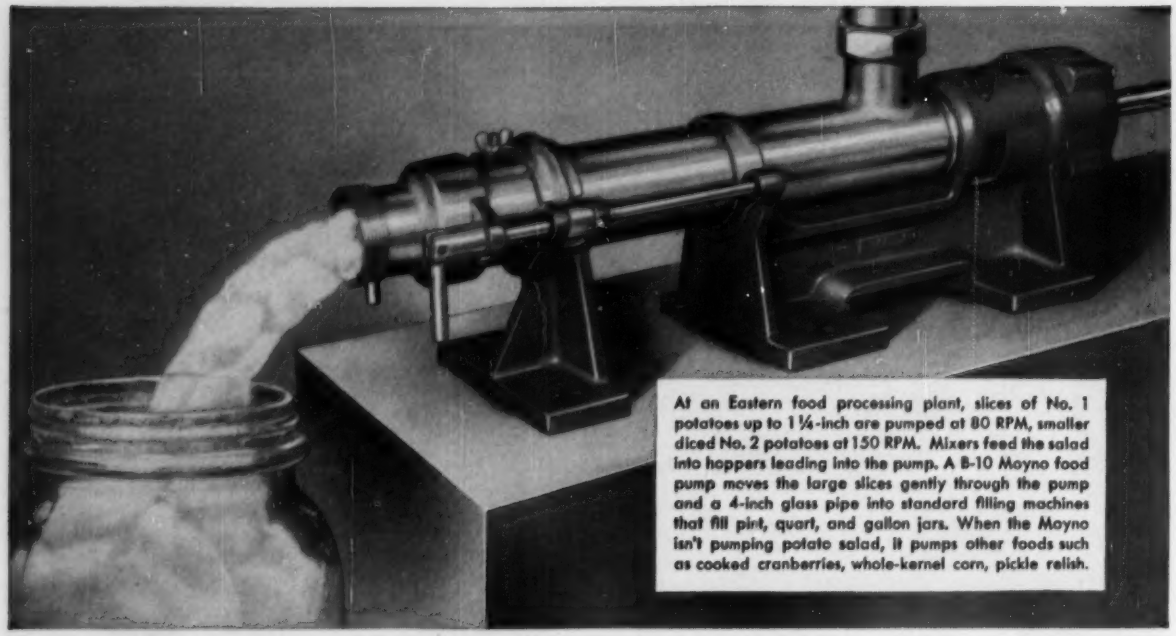

At an Eastern food processing plant, slices of No. 1 potatoes up to 1¼-inch are pumped at 80 RPM, smaller diced No. 2 potatoes at 150 RPM. Mixers feed the salad into hoppers leading into the pump. A B-10 Moyno food pump moves the large slices gently through the pump and a 4-inch glass pipe into standard filling machines that fill pint, quart, and gallon jars. When the Moyno isn't pumping potato salad, it pumps other foods such as cooked cranberries, whole-kernel corn, pickle relish.

Unusual Pumping Problem? Maybe This Moyno® Pump Can Help You Solve It

The Moyno can pump potato salad and a lot of other materials without making mush out of them—because of the unique *progressing cavity* principle.

Moynos have no valves and pistons, no vanes or other devices that cause churning and turbulence. The Moyno has a simple screw-like rotor turning within a double-threaded stator. This design creates cavities which progress smoothly toward the discharge end of the pump, carrying the material being handled. The material is not squeezed or churned.

Pumps Practically Anything

That's why the Moyno successfully handles such hard-to-pump materials as non-pourable pastes, frits, plaster, highly volatile liquids, and materials containing large particles, such as potato salad, fruit, cherries, chow mein—even oysters! In fact, the Moyno handles practically anything that will pass through a pipe.

Wide Range of Sizes

Moynos pump many hard-to-pump materials with a minimum of abrasion and wear. Many plants have adopted Moynos simply because they last so long.

Moynos provide positive displacement. Moynos can pull up to 29 inches vacuum while discharging under pressure. Big Moynos deliver up to 500 gpm; can provide pressures up to 600 psi in the smaller frame sizes. They even get up to 1000 psi momentarily.

The Moyno is reversible—it pumps equally efficiently in either direction.

With the Moyno, accurately metered flows are obtainable by regulating operating speed.

Moynos are trouble-free. They are self priming; won't cavitate or vapor-lock. There's just one moving part—no valves to stick, no pistons to gum up. Built for tough service. Easy to maintain. Moyno pumps are easy to take apart for cleaning.

Write For Bulletin

You may save a good deal of money or solve a tough problem by finding out about this simple, versatile pump. Write for Bulletin 30CE.

HOW IT WORKS

Rotor is like a stretched-out corkscrew. It turns within a stator that has a double internal thread. Thus rotor and stator form closely fitted cavities. As the rotor turns, these cavities progress evenly toward the discharge end of the pump without closing up. That's why the Moyno easily handles materials without crushing, churning, or aerating; and why it can handle so many different things—solids in suspension, pastes, abrasives, highly volatile liquids, tars, soaps, caustics—even cement and plaster.

FOR DESIGN ENGINEERS

Moynos are available in small sizes and special designs for use in automatic washers, drink dispensers, sprayers, oil burners, machine tools, gasoline pumps, and a wide variety of other equipment. If you are designing machinery, we'll work with you, in confidence, to integrate pump design with your problem.

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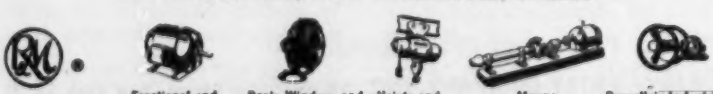
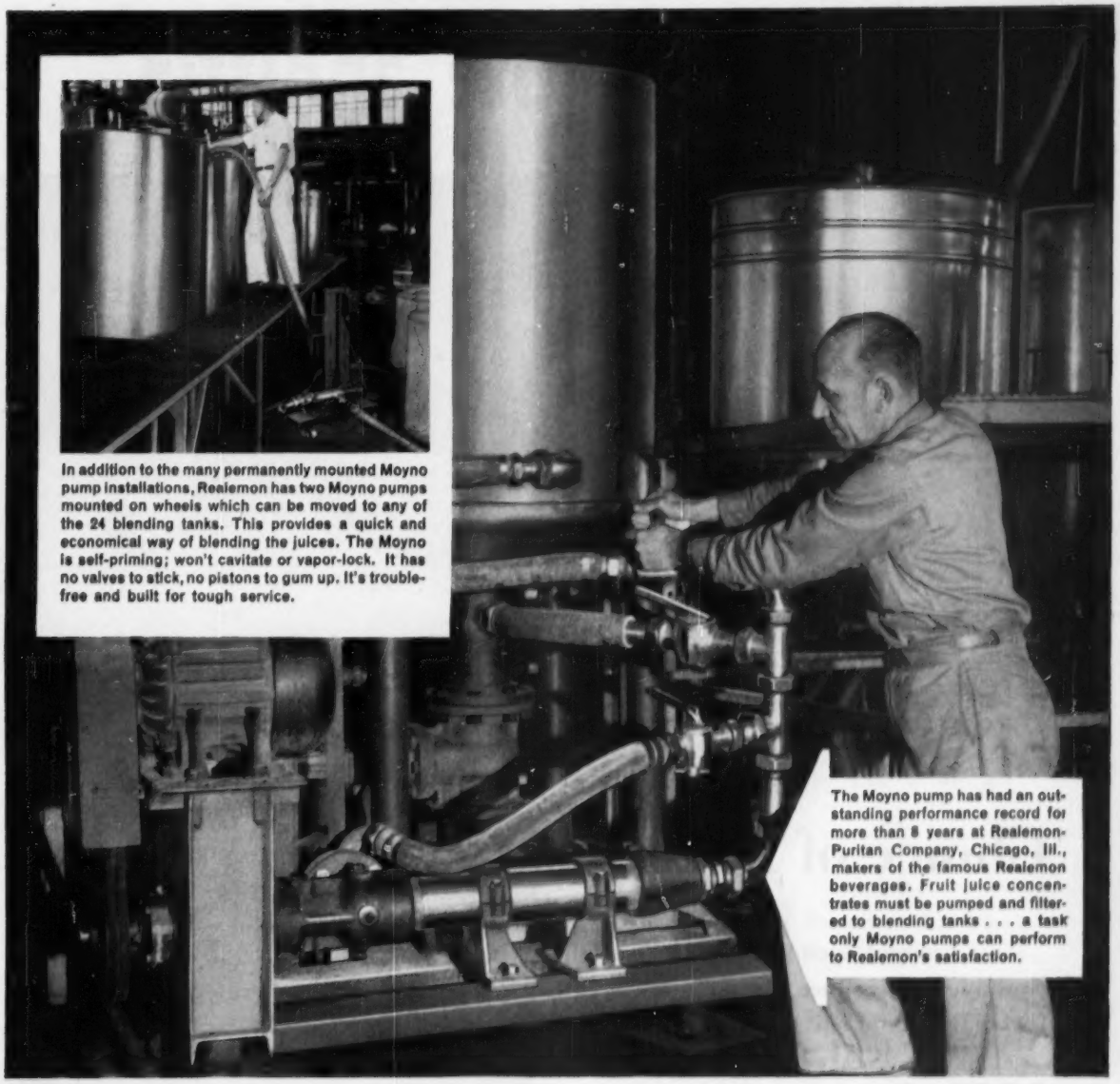


Fractional and Integral HP Motors | Desk, Window, and Household Fans | Hoists and Cranes | Moyno Pumps | Propellair Industrial Ventilating Equipment



In addition to the many permanently mounted Moyno pump installations, Realemon has two Moyno pumps mounted on wheels which can be moved to any of the 24 blending tanks. This provides a quick and economical way of blending the juices. The Moyno is self-priming; won't cavitate or vapor-lock. It has no valves to stick, no pistons to gum up. It's trouble-free and built for tough service.

The Moyno pump has had an outstanding performance record for more than 8 years at Realemon-Puritan Company, Chicago, Ill., makers of the famous Realemon beverages. Fruit juice concentrates must be pumped and filtered to blending tanks . . . a task only Moyno pumps can perform to Realemon's satisfaction.

Moyno® Pump exclusive choice of Realemon engineers for pumping juice concentrates

In the preparation of many of the famous Realemon products, concentrated fruit juices often must be pumped and filtered to blending tanks.

Pumps formerly used to handle this exacting process wore out completely in a few months because of their inability to stand up under the high acids in citrus juice concentrates.

Realemon then changed to the Moyno pump. Its unique rotor and stator arrangement forms sealed progressing cavities that move the material and provide positive displacement. For this Realemon application, Moynos with chrome-plated rotors and synthetic rubber stators were selected, to assure trouble-free service and long pump life.

Moyno pumps have now been in operation at Realemon for more than eight years, with an outstanding performance record. The only maintenance required is simply to replace the rotor and stator about once a year.

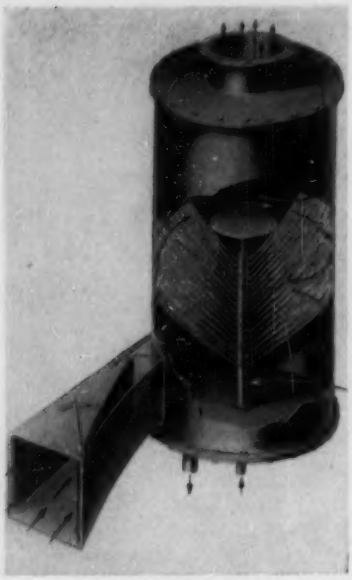
Moynos regularly handle a wide variety of products that other types of pumps can't handle—products such as potato salad, chow mein, fruit, alkalis, pastes, paints, tar —even cement and plaster.

Perhaps the Moyno will solve your pumping problems, too. Write us today for complete information. Ask for a free copy of Bulletin 30-CE.

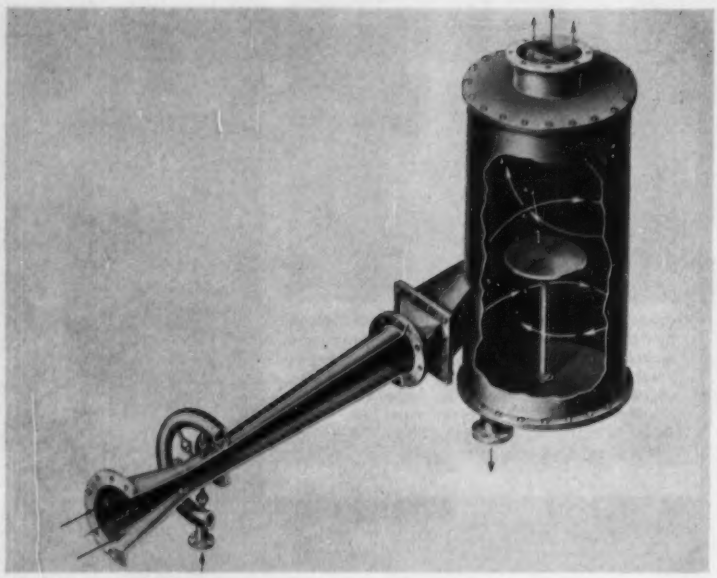
ROBBINS & MYERS, INC.

MOYNO PUMP DIVISION

Springfield, Ohio
Brantford, Ontario



CYCLONIC SCRUBBER



VENTURI SCRUBBER

Choice of Materials for Gas Scrubbers

Current spending of $100 million annually for equipment to reduce air pollution creates need for information about suitable materials.

H. P. Willett, Chemical Construction Corp., New York, N. Y.*

Until recently, gas scrubbers were used almost exclusively in industrial plants where the recovery of valuable dusts and fumes was an economic must for the operator. The practice of dumping all waste materials into the atmosphere was accepted by the public as a necessary evil—the days when a smoking factory was a prosperous factory.

Recent events like the Donora incident in 1948 in which 20 people died and several thousand were made ill, the London disaster of 1952 in which 4,000 people died, and the perpetual Los Angeles smog, have made the general public keenly aware of the menace of air pollution.

Under pressure, and in many cases, because of a genuine desire to be good neighbors, industry is now spending in excess of $100 million annually to prevent air pollution. All signs point to an even greater expenditure in the immediate future. As a result, selection of appropriate materials for the construction of gas scrubbing equipment assumes a correspondingly larger role.

The unit operation called "gas scrubbing" covers the removal of a contaminant from a gas stream with the aid of a liquid. The contaminant may be solid particles, such as dusts or metallic fumes, or it may be a liquid aerosol, such as acid fumes or oil fogs. Occasionally, the contaminant will be an invisible gas, such as H_2S or mercaptans, which create objectionable odors. The liquid used as the cleaning agent is generally water, although in some cases other liquids such as acid or alkali solutions, brine, fuel oil and even molten sulfur are required.

Although most of our corrosion experience in the field of gas scrubbing has been with Pease-Anthony type gas scrubbers, the material in this article will apply in general to any of the other scrubbers on the market today. The only exception: in some cases complexity of design might preclude the use of certain types of corrosion-proof construction. For example, a gas scrubber having a multitude of baffles, plates, vanes, etc. would not lend itself well to acid brick lining, gunited acid proof cement or rubber lining.

Illustrations above reveal the physical size and shape of the equipment we are considering.

The first illustrates the P-A cyclonic scrubber in schematic

*Meet your author on page 355.

Fittings stay fastened in Corrosive Acid Spray

PROBLEM:

Selecting fastenings that would hold pipe fittings together in a unit that is constantly subjected to a hot sulphuric acid spray. Bolts were formerly falling apart in four months' time.

REMEDY:

Use of nuts and bolts made of wrought HASTELLOY alloy C.

RESULT:

Fastenings made of HASTELLOY alloy C are still holding many months after ordinary bolts had to be replaced.

HASTELLOY alloy C is the most universally corrosion-resistant alloy available today. In addition to aerated sulphuric acid, it has excellent resistance to such strong oxidizers as nitric acid, wet and dry chlorine, and acid solutions of salts. It is available in nearly all standard commercial forms.

For more information on HASTELLOY alloy C, get in touch with the nearest Haynes Stellite Company Office.

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form. Note that the device is essentially a vertical cyclindrical tank devoid of internal parts—other than a central spray manifold and so-called corebuster. The gas to be cleaned enters tangentially, spirals around through a spray zone where dust and atomized water originating from central sprays coalesce to form agglomerates. These are removed from the gas stream in the separating zone by the centrifugal force of the spinning gas stream. The cleaned gas leaves at the top while the scrubbing liquid containing the contaminants is withdrawn from the bottom.

These scrubbing units are designed for collecting dusts larger than 1 micron in diameter and are not effective on fumes or sub-micron dusts. Physical dimensions range up to 12 ft. in diameter by 40 ft. high for capacities of 75,000 cfm. Simplicity of design makes it easy to fabricate from a variety of special materials of construction.

A schematic of the P-A venturi scrubber is also shown. The gas to be cleaned enters the venturi sections, and is accelerated to high velocities in the throat (or constricted) section where the scrubbing liquid is injected at right angles to the flow of gas. A violent impaction of gas on liquid at this point is responsible for the good performance of this type of scrubber on difficult-to-collect sub-micron particles. The vessel following the venturi is simply a centrifugal type entrainment separator. No spray is added beyond that introduced into the venturi.

Most Common Offenders

Probably eight out of ten gas scrubbing problems develop conditions which require corrosion protection to varying extents.

By far the most prevalent offender is sulfur dioxide, which is formed in all combustion processes where sulfur is in the fuel or in the material burned. While not considered a seriously corrosive agent, the sulfurous acid which forms upon contact with water rules out the use of ordinary steel construction in most cases.

Note the use of the qualifying phrase "in most cases." Of course, we cannot afford to be dogmatic when discussing corrosion problems. There isn't another phase of engineering where more things happen that shouldn't, and where more things don't happen that should.

Besides sulfur dioxide, many more corrosive contaminants are frequently encountered in gas scrubbing work. These include sulfuric, phosphoric, nitric, hydrochloric and hydrofluoric acid fumes produced by the chemical industry. In most cases, the presence of only traces of these in stack gases requires the use of corrosion-resistant gas scrubbing equipment.

The fertilizer industry is noteworthy for its byproduct fluorine and phosphoric acid fumes. The metallurgical industry is heavy on sulfur dioxide and sulfuric acid fumes. The petroleum people are troubled with hydrogen sulfide, sulfuric acid fumes, sulfur dioxide and oil fumes.

The task of finding suitable materials from which to construct gas scrubbers would be easier if each of the above-mentioned contaminants were present by themselves in a gas stream. Unfortunately, more often than not, two or more are present at the same time. This puts additional restrictions on the choice of available construction materials known to withstand the corrosive effects of each contaminant.

Sometimes, there seems to be a synergistic effect wherein the corrosive action of two agents together is worse than would be expected from the sum effect of each by itself. This may be compared with the dissolving action of aqua regia on gold. Its constituents, hydrochloric and nitric acid, are non-reactive taken singly.

NEXT MONTH:

COMPARABLE PAINT COSTS

Nomograph method gives paint costs on a dollar per mil sq. ft. basis. For the industrial consumer, the price of paint per gallon alone is no criterion. Need for method becomes more acute with the number of new coating resins coming into general use.

Temperature Limitation

Another factor frequently present in gas scrubbing problems, which severely limits the choice of construction materials, is high gas temperatures.

Prolonged temperatures over 200 F. rule out the use of most organic type linings and coatings, as well as most unsupported plastic materials. Exceptions are certain special rubber linings such as Hypalon which is recommended for continuous service up to 250 F. Molded reinforced plastics such as Haveg and Permanite are recommended and have been used successfully up to 300 F. Our experience indicates that corrosion resistance and—what may be more important—resistance to expansion failure may be compromised somewhat at these temperatures.

For temperatures up to 500 F., the fluorocarbons such as Teflon or Kel-F are very useful, although their high cost generally limits their use to smaller component parts of a gas cleaning system. Expansion joints, gaskets and spray nozzles are typical of such applications.

Obviously, the alloys are not subject to the same temperature limitations as the organics. However, extreme caution must be taken since corrosion rates rise rapidly with temperature when metals are in contact with a corrosive liquid.

Still another complicating factor is the presence of abrasive solids in the gases to be cleaned. Under some conditions, these are apt to remove protective films which normally render certain metals corrosion-resistant. An abrasive condition also rules out many of the thin-filmed plastic coatings.

Problems With Accessories

A common accessory in nearly all gas cleaning operations is a fan or blower which is required to move the gases through the system. Because of the stresses involved in the rotating impeller, additional limitations on materials selection are imposed.

For fans developing low static

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Dry Cake Discharge

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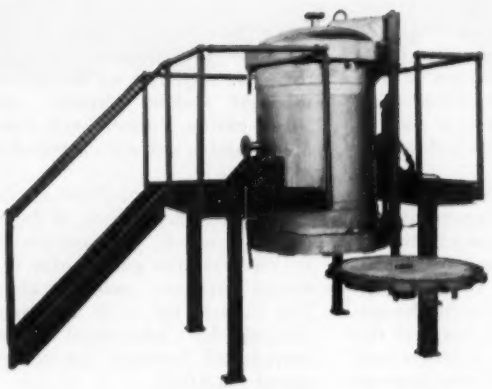

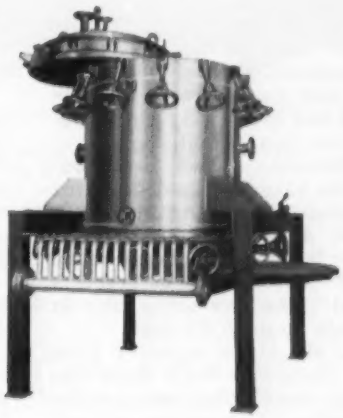

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Enzinger filters are built with either conventional hand wheel or quick-opening top and bottom closures. Air or gas inlet speeds up drying. The cake can be dumped into a hopper or conveyor without removing the leaves from the filter. For the maximum in filtration, call or write.

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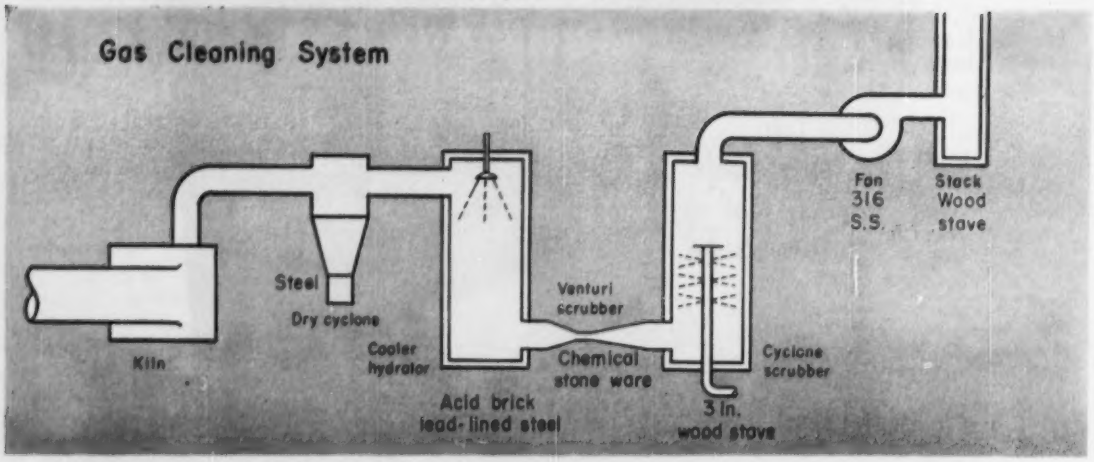

GAS CLEANING SYSTEM using a variety of materials for construction of component parts. (Fig. 3)

pressures below 12 in. w.g. corresponding to tip speeds of about 12,000 fpm.), many materials have been used. These include filled cast plastic, reinforced compressed plastics, rubber lining and many sprayed coatings —as well as any alloy which happens to be resistant.

Recently, rubber manufacturers have developed improved methods of bonding rubber to steel. At least one fan manufacturer is now willing to guarantee good performance on rubber-lined fans operating at tip speeds up to 25,000 fpm.

It should be apparent from the foregoing that there are many complicating factors in the selection of materials of construction for gas scrubbers. There are no set patterns to follow, no rules of procedure which, if followed, will guarantee success. Broad practical experience in such matters is the best insurance for success.

Specific Selection Problem

Let's take a look at a specific gas cleaning problem to learn why different materials were selected for the several components. Refer to the drawing of the gas cleaning system.

The process causing the pollution problem here is the roasting of copperas to produce iron oxide pigment. In the rotary kiln, copperas (or ferrous sulfate) is decomposed by direct firing. The sulfate is converted to SO_3 and SO_2, which leave the kiln with the flue gases at about 800 F. At this temperature the gases are well above the dew points of water vapor and acid contaminants, so that ordinary steel ductwork is suitable.

The same construction is adequate for the dry cyclone which is installed to remove a portion of the entrained iron oxide dust as a dry powder.

Now when the gases are cooled to the required temperature of 240 F. in the cooler-hydrator by controlled additions of water spray, we have the severest conditions for corrosion in the entire system. This is because the gases are below the sulfuric acid dew point, yet the temperature level is still relatively high. The vessel, therefore, is constructed of a steel shell lined with lead and acid brick in accordance with standard acid plant practice.

The same construction could have been continued throughout the remainder of the system with absolute assurance of long service life. However, since this entire project is a marginal one from an economic standpoint, it was necessary to use the least-expensive materials consistent with reasonable service life.

Acid brick—lead lined steel is the ultimate in corrosion proof construction, but cannot be justified where lower cost substitutes can be used successfully.

The venturi tube following the cooler-hydrator was in this case fabricated from cast chemical stoneware. This material is almost completely resistant to the acids present, and thermal shock is not severe. A few of the other materials from which similar venturis have been constructed for other applications include reinforced molded phenolic and furan resins, rubber-lined steel, Monel and a variety of stainless steels.

The cyclonic scrubber in the application in question is fabricated from 3-in. redwood staves. By the time the gases enter this vessel, they are cooled to about 100 F. and the acid is greatly diluted by additional water introduced through the central spray manifold.

In other instances, this type of vessel has been fabricated from the same materials mentioned in connection with the venturi. One of the most economical as well as serviceable materials, especially for protection against sulfur dioxide, has been a 2-in. thick coating of alumnite cement gunited against a steel shell.

Note that the duct following the cyclonic scrubber and the fan itself are type 316 stainless steel. The fan wheel failed due to severe corrosion within a week after the plant was started. Investigation proved that the trouble was caused by accumulation on the fan blades of sulfuric acid having a concentration incompatible with the stainless steel. The heat of compression, amounting to about 15 F., apparently was sufficient to con-

you can

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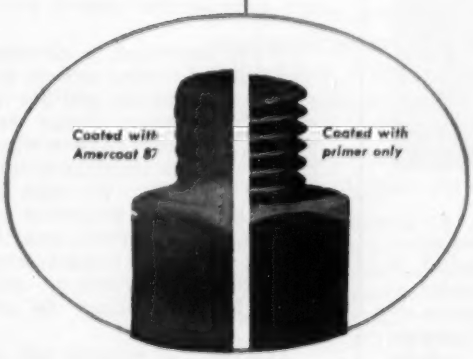
4. Greater thickness means longer life—lower cost per square foot per year.



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centrate the traces of weak acid accumulated in the fan to the danger point.

The problem was solved by installation of tiny water spray nozzles at critical locations in the fan casing. This limited the temperature rise and kept the acid dilute. No further corrosion has resulted in over five years of operation.

Corrosion Fatigue With Fuming Nitric Acid

Corrosion fatigue of various metals used in handling fuming nitric acid is the subject of a report of Air Force research just released to industry by the Office of Technical Services, U. S. Dept. of Commerce.

Investigations were made on RC-70 titanium, titanium alloy Ti-150-A, Armco 17-7PH stainless steel, and 2S aluminum in white fuming nitric acid (1.5% NO_2) and red fuming nitric acid (10.5% NO_2) at room temperature.

Some of the findings indicate that the fatigue life of the titanium and the stainless steel is shortened. Armco 17-7PH was not subject to stress corrosion. Both 3S and 61ST6 aluminum appear to be subject to concentration cell corrosion in white fuming nitric acid.

Polarization data on aluminum and stainless steel agree favorably with actual data obtained from natural galvanic couples of these materials. When aluminum is made anodic to platinum in fuming nitric acid a phenomenon of anodic passivity occurs at certain values of impressed potential. Corrosion rate of stainless steel can be reduced to a very low value by cathodic protection.

This report, PB 111877 "Materials for Handling Fuming Nitric Acid and Properties of Fuming Nitric Acid with Reference to its Thermal Stability," May 1955, Ohio State University Research Foundation for Wright Air Development Center, is available from OTS, U. S. Dept. of Commerce, Washington 25, price $2.25. This report contains 83 pages.

Battling Embrittlement

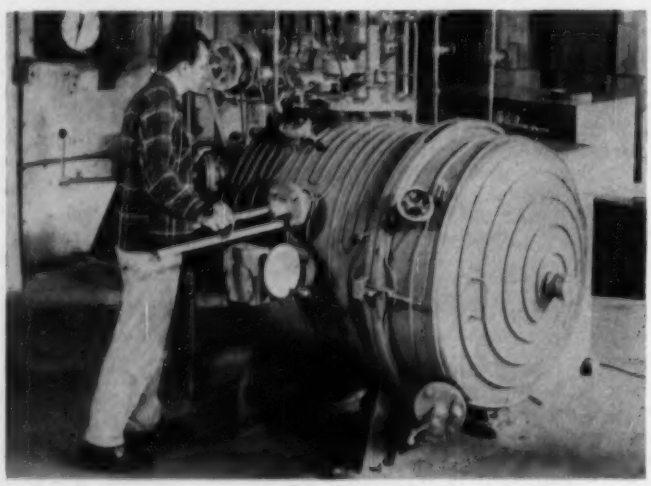
Chemical engineers at Yale have started working on one of the petroleum industry's most persistent and, potentially, most dangerous problems.

For years it's been known that high pressure hydrogen embrittles metals. Since these metals form the walls of vessels used in many phases of refining plant operations, such embrittling spells danger. The embrittled walls of these vessels occasionally explode, or, more frequently, simply deteriorate. Hence, for both safety and economy, engineers are anxious to know what causes this embrittling, and how it can be stopped or at least minimized.

Barnett F. Dodge, professor of chemical engineering and chairman of the department of chemical engineering at Yale, is now directing the research project.

"We're interested in learning why this embrittling process occurs in some metals and not in others," Professor Dodge explained. "We want to know what metals are most resistant to this process, and why. We want to learn the specific properties of these metals that resist embrittlement when in contact with high-pressure hydrogen and what the controlling factors are."

As a result of research now in progress at Yale, the petroleum industry may be able to develop a coating that will protect metals against embrittlement, or may be able to modify the structures of these metals in such a way as to make them resistant to this process.



New Facilities for Better Steels

National Supply Co.'s research facilities for studying super quality steels have been expanded at Torrance, Calif., by installation of a vacuum melting furnace in which experimental quantities (up to 50-lb. ingots) of these steels and alloys are produced. The operator slides a control arm to charge desired amounts of alloy into the crucible, as he watches the melting process through an inspection port. Steel to be melted is charged through a chamber on top of the furnace. Pressures are reduced to less than 5 microns.

Chemistry of steel refining will be investigated with the aid of a new vacuum fusion gas analyzer for accurate analyses of gases present in steels and evaluation of their effects on the quality of melted steels.

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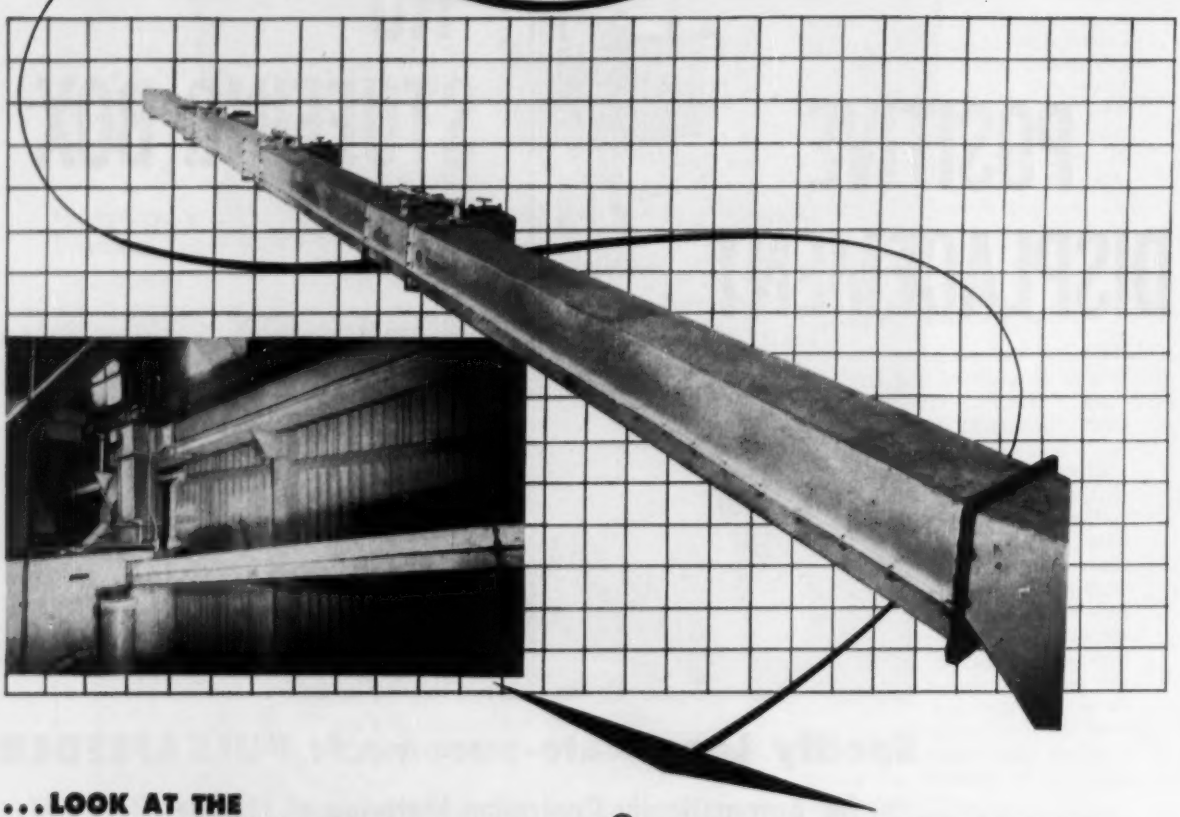

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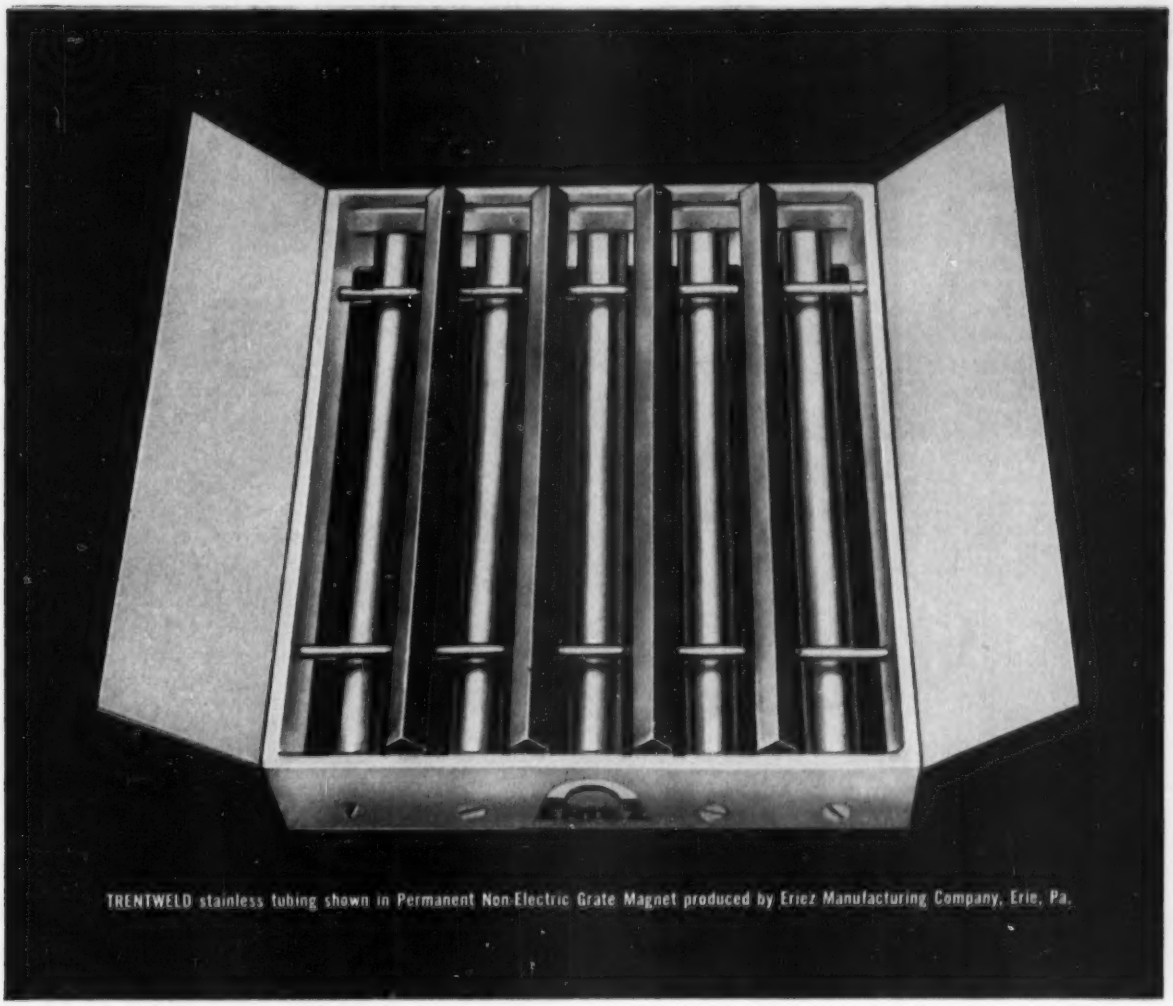

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how TRENTWELD stainless tubing traps "tramp iron" in product flow...

As free-flowing products such as chemicals, grains, sugar or spices flow through this separator unit, large and small iron contamination is seized by powerful magnets and held firmly to the five stainless steel tubes.

This is a unit that's normally given long, hard use. That's why TRENTWELD stainless steel tubing is chosen to house the Alnico V magnetic elements. For stainless resists abrasion and corrosion . . . its smooth surface offers a minimum of resistance to product flow . . . and stainless is strong—lasts indefinitely. What's more, stainless is the easiest of metals to keep clean and sanitary.

And equally important to you is the fact that TRENTWELD is made by *tube mill specialists* —by the new, patented *Contour-Weld** Process. That means stainless pipe or tubing with a smoother I.D., free from any weld bead or undercut.

So when you need stainless or high-alloy pipe or tubing, make sure it's TRENTWELD. You can't buy better!

TRENTWELD

STAINLESS STEEL TUBING

*Contour-Weld is the trade mark of the Trent Tube Company for its processes of welding pipe and tubing which is protected under U. S. Patent 2,716,692.

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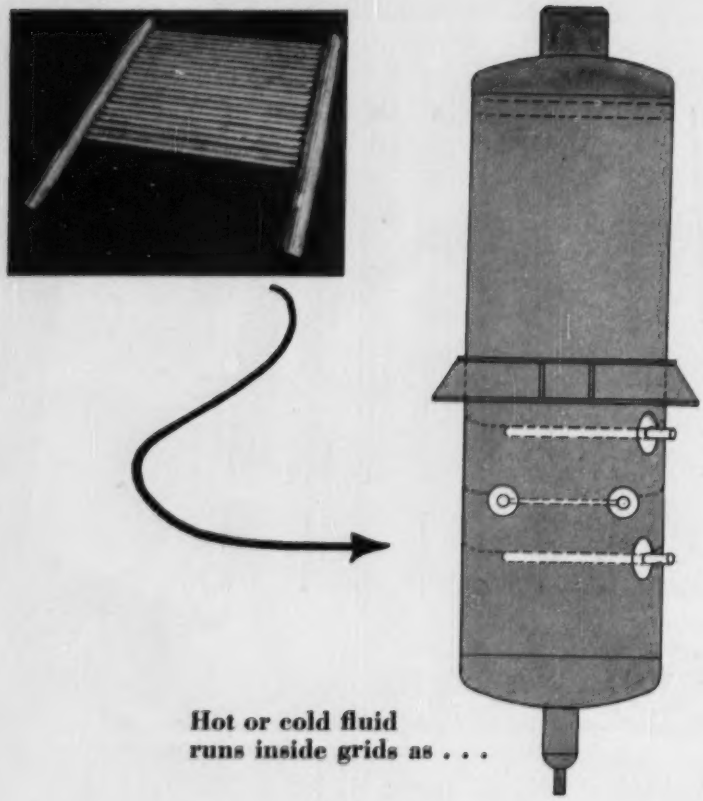


Hot or cold fluid runs inside grids as . . .

Tray Controls Column Heat

Column tray now is modified to heat or cool throughput. For the user it will lower capital costs, control temperature more effectively, improve product.

Temperature of gas or vapor and liquid flowing through columns now can be controlled more uniformly and precisely with a modified version of Shell Development Co.'s Turbogrid distillation tray.

Original design of the Turbogrid tray (*Chem. Eng.*, Sept. 1952, p. 176) featured rectangular bars laid horizontally parallel to each other across the entire column cross-section and spaced apart to provide slots.

In the modified design, hollow tubes have replaced the bars. By circulating heat transfer medium through these tubes, heat can be added or removed from specific trays in the column without diluting the process stream.

Hollow Turbogrid trays look promising for distillation of heat-sensitive mixtures such as fatty acids, dehumidification of gas streams, generation of internal reflux, intercooling of liquids as in an absorber, increasing cooling tower capacity.

On the West coast, Southwestern Engineering Co. has already designed and built one installation for fatty acid, is now completing a fully instrumented and automatic package plant based on the new tray. Other companies, such as Pfaudler and National Carbon, also have licenses from Shell Development for Turbogrid developments in their particular specialties, i.e., glassed steel and Karbate brand impervious graphite.

▶ **What Tray Can Do**—Individual tray efficiency of the Turbogrid generally is less than that of a well-designed bubble cap tray. But lower pressure drop and smaller permissible tray spacing make for less pressure drop per theoretical tray. Column height is about the same as in bubble-cap installations.

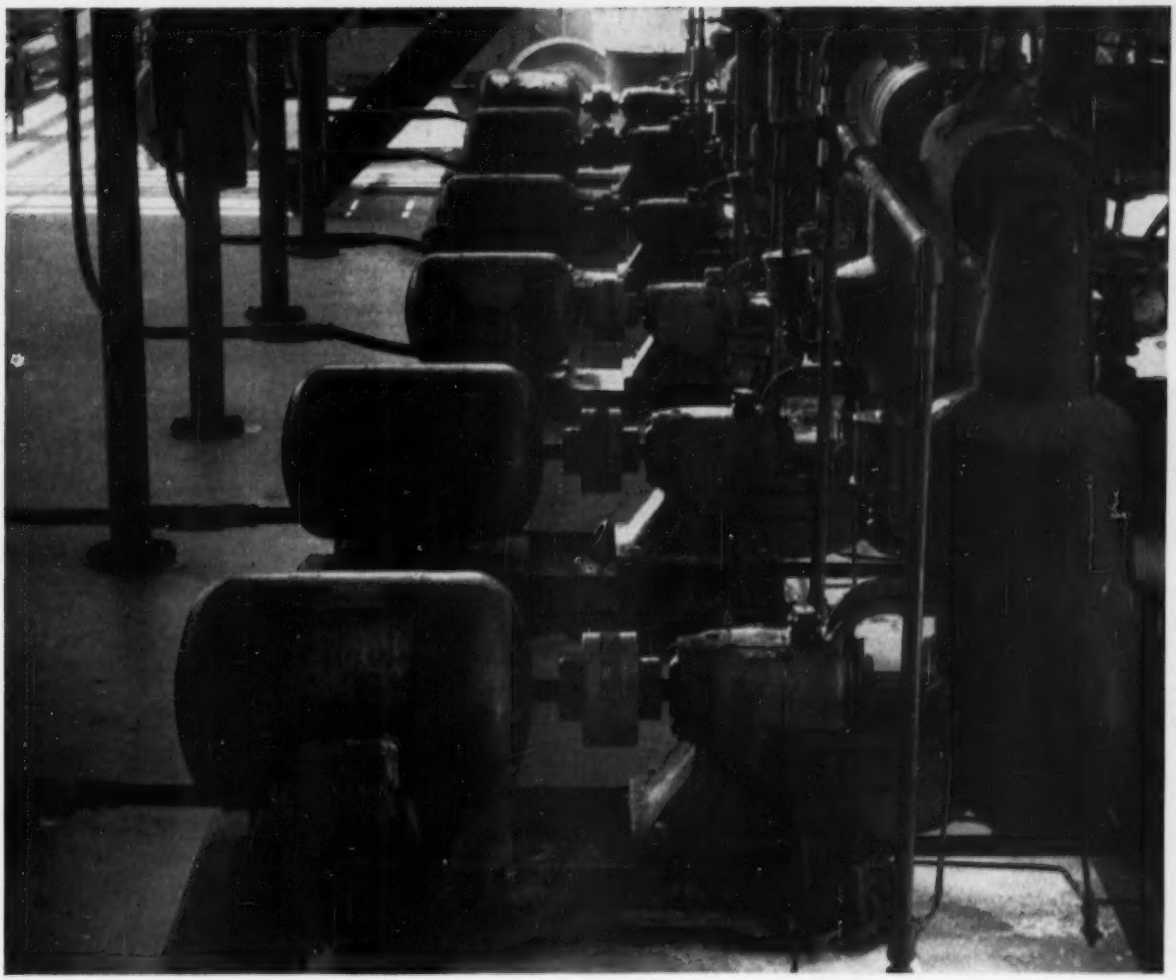
The new hollow-tray design does not differ markedly from the basic Turbogrid design save in such manifolding as is required at the sides of the trays. About 2.5 sq. ft. of tube surface per sq. ft. of column cross section are available for heat transfer. This is substantially greater than conveniently can be built into a hollow bubble-cap tray.

Transfer medium may be steam, Dowtherm vapor, or the like, depending upon process needs. Intimate contact between a tray and the process stream under the most favorable conditions produces heat fluxes up to 300 Btu./hr./deg. F./sq. ft. of column cross section.

High liquid viscosity on the tray side, scaling or fouling all decrease the heat transfer coefficient, but to no greater extent than would occur with other types of column internal exchangers.

▶ **Operating Report** — To date, the principal operating data come from the commercial fatty acid distillation unit constructed by Sweco.

To command top prices, fatty acid products have to be almost colorless. Production of the desired colorless fraction by distillation is handicapped by tendency for color to develop when



The Answer To a Tough Problem — They Bought **LaBours**

Handling resins and fatty acids at temperatures up to 520°F calls for pumps with real ability to stand up under punishment. That's why this picture from the Bay Minette, Alabama, plant of Newport Industries, Inc., shows six LaBour pumps.

These pumps have steam jacketed heads and water cooled seals and bearing brackets. The great advantage of having LaBours: you know they can be depended on for long trouble-free service. As this is written these pumps have been on the job nearly two years.

Cost-conscious buyers know the real measure of pump economy is not the original price, but the service rendered per dollar of total cost for the life of the equipment. Because LaBour pumps minimize down-time and repair expense they welcome this realistic comparison. We'll be glad to supply some interesting facts at your request.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

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Newsworthy Equipment This Month

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New Processing Equipment
- Column Tray 238A
- Dispersion Mill 240A
- Vacuum Still 242A
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- Demineralizer 242C
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New Instruments & Controls
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New Electrical & Mechanical Equipment
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- Non-Slip Belt 246E
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New Fluids Handling Equipment
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- Leakproof Pump 248B
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- Centrifugal Pump 248D
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- Plastic Pipe 250A
- Wet Dust Collector 250B
- Control Valve 250C
- Tube Fitting 250D
- Pipe Coating 250E
- Diaphragm Valve 252A
- Solenoid Valve 252B
- Canned Pump 252C
- Check Valve 252D
- Centrifugal Pump 252E

New Packaging & Handling Equipment
- Vibratory Feeder 254A
- Boxcar Unloader 254B
- Hot Material Conveyor 254C
- Bulk Liquid Container 254D
- Conveyor-Cooler 254E

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acid is heated for any prolonged interval. Also, material is oxygen sensitive. Ninety percent of column feed leaves overhead as product, making heat input to such a heat-sensitive system a difficult problem indeed.

A vacuum distillation unit using hollow bubble-cap trays heated with Dowtherm has been found to operate satisfactorily on fatty acid. However, it is relatively expensive, extremely difficult to maintain and requires excessive pressure drop (1-2 mm. Hg) across the tray for efficient operation.

By contrast, using the hollow Turbogrid, Sweco has produced a smaller diameter column with a simpler tray installation that costs 20-25% less than the comparable hollow bubble-cap column. During one year on stream, maintenance on the column has been negligible.

Furthermore, Sweco's column has only a 0.70 mm. pressure drop per tray in the good operating range. Across the column including the demister, total drop averages 3 or 4 mm. Hg.

Temperatures throughout the column are held to a minimum; heat is applied where and when required. Using Dowtherm vapor, the heat transfer coefficient per tray is about 20 Btu./hr./deg. F./sq. ft., based on one half the total tube area in tray (upper half only of each tube).

Product quality is governed by striking the desired economic balance between product color and recovery of fatty acid. An example of the product quality produced from brown grease feed (pork) is shown by a product with a Gardner color index (1933) of 2 when splitting 10% of the feed to bottoms. Maximum temperature in column is 480 F. with 6-7 mm. Hg pressure at bottom of column.—**Shell Development Corp., Emeryville, Calif.** 238A

Dispersion Mill

Uses turbulent jet flow to break pigment agglomerates.

A recently available dispersion mill helps paint formulators achieve maximum results from the pigments incorporated in the paints. Pigment agglomerates or clusters are separated into individual particles by the extreme turbulence generated in high-velocity flow through jets. Furthermore, these forces promote good wetting of the pigment particles by the vehicle.

Featuring integral construction, the Jet Mill has two major components: a motorized speed increaser and vessel assembled as a unit, and the jet milling assembly consisting of a rotor and diffusion ring.

The diffusion ring and its support form a shroud about the

Equipment Cost Indexes

Industry	Dec. 1955	Mar. 1956
Avg. of all	196.9	201.3
Process Industries		
Cement mfg.	188.8	192.5
Chemical	198.1	201.9
Clay products	183.4	187.0
Glass mfg.	197.1	190.7
Paint mfg.	190.6	194.3
Paper mfg.	190.9	194.6
Petroleum ind.	194.5	198.3
Rubber ind.	197.0	200.8
Process ind. avg.	194.6	198.4
Related Industries		
Elec. power equip.	199.9	203.8
Mining, milling	199.3	203.2
Refrigerating	219.0	224.9
Steam power	186.6	190.2

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See *Chem. Eng.*, Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1956, pp. 194-5 for annual averages since 1913.

Actual laboratory pre-tests prove you can...

Blend liquids into dry materials fast, in one operation... without lumps

Getting perfect dispersions of liquids into dry materials without lumping has almost always entailed extra steps for pulverizing, mulling or screening, etc.

But P-K's new *Liquid-Feed** Twin Shell Blender eliminates those extra, costly operations. Now, in a one batch operation, you can achieve complete dispersion of liquids in a matter of minutes. Blender is charged through large dust-tight openings that allow easy access to shell interior for cleaning. Complete Liquid-Feed assembly is quickly removed by means of a spring loaded mechanism.

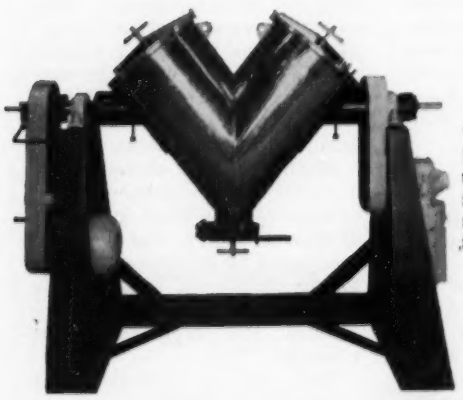
The Liquid-Feed blender is simple in concept. Liquid flows from a feeder tube within the bar onto a revolving distributing disc. Centrifugal force flings a fine spray outward. Dry materials tumbling in the Twin Shell receive liquid in controlled amounts at all times. The wire cage, spinning at high speed, prevents the formation of lumps before or after liquid is introduced.

Results? More perfect blends, in a fraction of time previously required. Want proof? P-K's Process Division maintains a complete lab to assure accurate, predetermined performance to meet your liquid-feed blending requirements. P-K will conduct, without obligation, laboratory test-blends with your materials.

Experimental testing will provide operational procedure and scale-up data. All test reports are held in strict confidence when desired, and, whenever convenient, testing may be supervised or witnessed by your personnel. P-K will submit complete factual test results, including samples of test-blends. Write direct to our Research Department.

The Patterson-Kelley Co., Inc.,
170 Hanson Street, East Stroudsburg, Penna.

*patented and patents pending

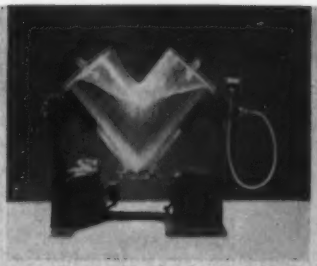


This production model is in stainless steel. Standard liquid-feed twin shell blenders are available in most commercial metals. Sizes range from 3 to 50 cu. ft. working capacity.

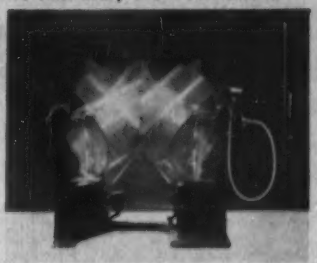
Patterson Kelley
Chemical and Process Division

2599

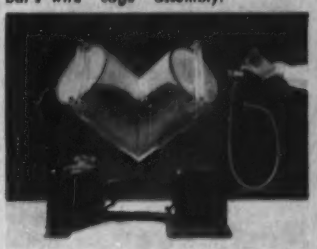
Twin Shell Blenders • Autoclaves • Pilot Plants • Heat Exchangers
Ribbon and Double Cone Blenders • Lever Lock Doors



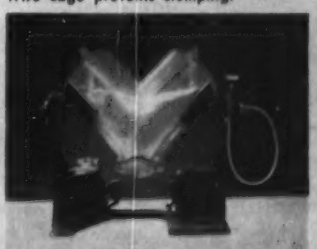
8 qt. blender is loaded for test with dissimilar materials, one lumpy and light, the other heavy and fine in texture.



Complete uniformity is obtained in a few minutes by dry blending. Lumps are broken up by fast-spinning intensifier bar's wire "cage" assembly.



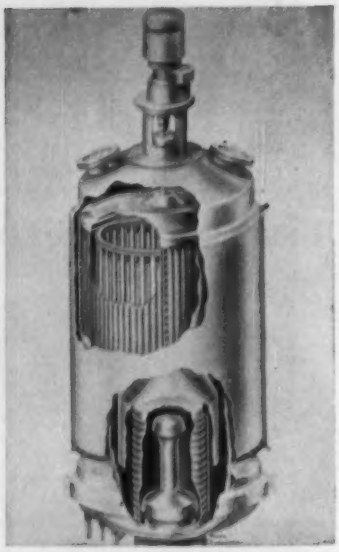
Liquids are then introduced into the dry blend during rotation by gravity-feed. Distributing disc disperses liquid evenly. Wire cage prevents clumping.



Average blending time is approximately 15 minutes to obtain perfect liquid-feed mix. One step operation eliminates pulverizing, mulling and screening.

Discharging is easy. Stainless steel liquid-feed assembly ejects instantly, rinses in seconds. Seconds more to wipe clean the smooth, easy-to-get-at interior.

main central working impeller. The impeller is an integrally assembled combination of down-feeding turbine propeller and a radial-flow double-suction centrifugal impeller. Slots in the centrifugal impeller and diffusion ring act as channels for the jetting action. Both cavitation and shear contribute in large measure to the dispersive action.—**The Patterson Foundry & Machine Co., East Liverpool, Ohio.** **240A**



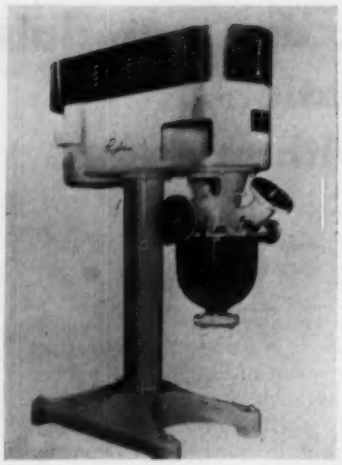
Vacuum Still

For simple and continuous operation at low cost.

Large capacity on a continuous basis can be handled by the new Rota-Film high-vacuum still. Featured as a sanitary, self-cleaning packaged unit, this falling-film still operates easily under controlled or variable conditions.

The highest vacuum requirements are reached with ease by a diffusion pump built into the housing. Slow-speed Rota-Wiping equipment distributes a uniform, thin-film over the entire evaporating surface. Exposure time is only a fraction of a second.

Stills are available as 12-in. unit packaged for pilot plant operation, or with 36, 48,, 60 or 96-in. dia. evaporative surface. —**Arthur F. Smith Co., Rochester 3, N. Y.** **242A**



Disintegrator

Designed for exceptionally wide range of applications.

Model RI disintegrator, added recently to the Rietz line of size reduction equipment, is said to handle an exceptionally wide range of applications throughout the chemical processing and related industries.

Units in the RI series are suitable for mounting in reaction vessels and for dispersing liquids under pressure. Also, they are ideally adapted to uniform, low-temperature size reduction and mixing of difficult-to-handle pasty masses.

Rotor diameter and speed can be changed easily. Thorough cleaning and sterilizing can be accomplished with ease.

Available in stainless or carbon-steel construction these machines are built with rotor sizes from 2 to 24 in. with ½ to 200 hp.—**Rietz Mfg. Co., Santa Rosa, Calif.** **242B**

Demineralizer

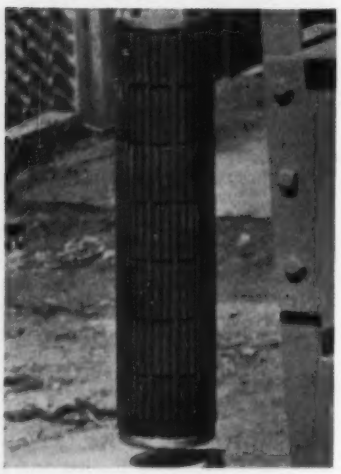
Produces extreme purity at low cost per unit volume.

Operating on the mixed-bed principle, the new MA-500 monocolumn demineralizer produces up to 500 gph. of water with resistivities as high as 15 to 20 million ohms. Cost is only a few cents per 1,000 gal.

All operating functions, including the regeneration cycle, are fully automatic. Need for regeneration is signalled by a red light. Turning one switch then actuates the regeneration cycle which completes itself automatically.

Only one regenerant tank is supplied since the acid is drawn directly from its container. Proper dilution is achieved by an eductor.

Model MA-500 requires only 2 x 3 ft. of floor space, is shipped as a completely packaged unit.—**Penfield Mfg. Co., Inc., 19 High School Ave., Meriden, Conn.** **242C**



Filter Elements

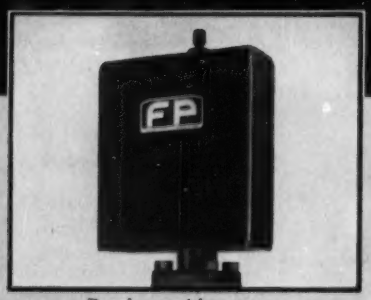
For vacuum thickener, made of plastic and rubber to withstand corrosives.

A new filter element now is available for use with the Edco vacuum tube-thickener. Elements are assembled from gear-like sections molded of plastic and rubber. The gear-like contour supports the filter fabric and provides channels for drainage of the filtrate.

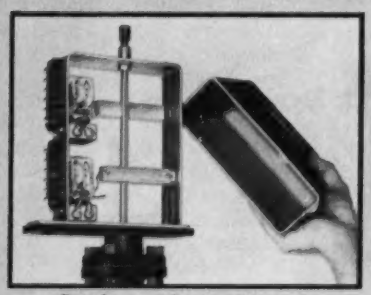
Sections of the elements are mounted over a stainless steel tube to form a filter grid area of desired length. For complete resistance to corrosion, special plastic tubes are used. Grids assemble or disassemble very rapidly for replacement or cleaning.

The vacuum tube-thickener concentrates slurries that are hard to filter on conventional filters, or are difficult to settle—**Equipment Development Co., Inc., 363 Bloomfield Ave., Montclair, N. J.** **242D**

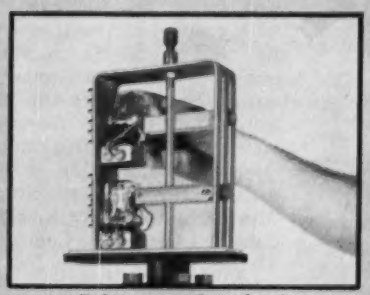
VIBRATION *proof* FLOW ALARM



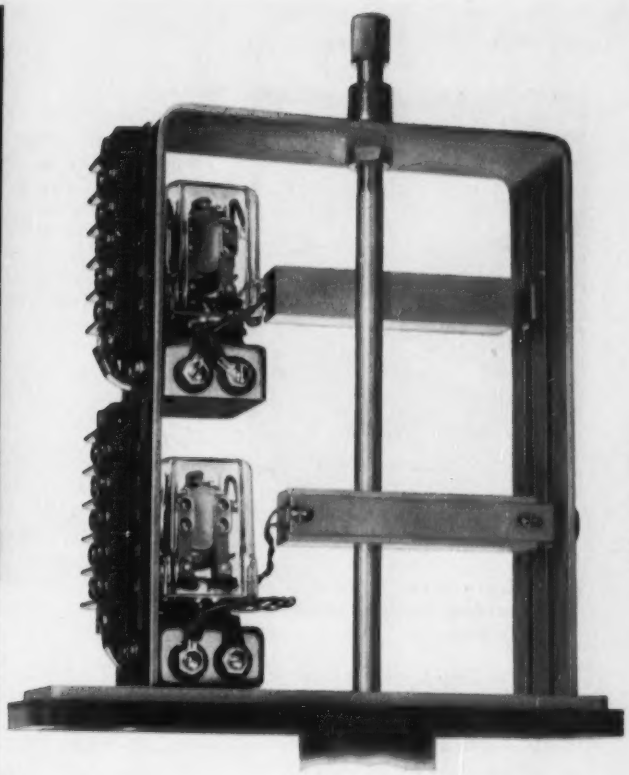
Ratolarm with cover on



Ratolarm with cover removed



Relays are easily replaced



At last a low cost flow alarm immune to vibration. For linear scale flowmeters and liquid level applications.

Snap-action electrical contacts are hermetically sealed in glass. Contact closure can be made *only* by passage of the magnetic float extension rod. False alarms are eliminated.

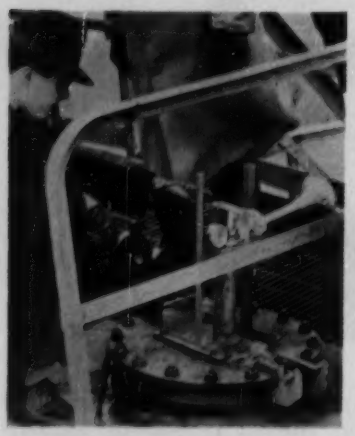
CONSIDER THESE ADVANTAGES:

- Rugged, vibration-proof, glass-sealed switch
- High, low or double alarm, adjustable to any scale position
- Dependable, long life, low cost, no electronic parts
- Explosion-proof construction available
- Plastic enclosed plug-in relays for easy maintenance

Write today for complete informtaion. Ask for catalog 10-A-84.

FP **FISCHER & PORTER CO.**

176 County Line Road, Hatboro, Penna.



Overflow Alarm

Alerts crew against tank overflow during filling operations.

When liquid level rises near the overflow point during tank filling operations, the Falcon tank-overflow horn sounds a warning that can be heard more than 1,000 ft. away. Signal continues for two to four minute interval, prevents dangerous and costly tank overflow due to failure of automatic equipment.

Device consists of a 2-in.-dia. steel cylinder of compressed gas, pressure gage, horn assembly and float-operated valve assembly. When liquid level in the tank nears the safe filling limit, the float activates mechanical linkage to the horn unit and starts the penetrating shrill warning.

Signal is rated in the 116-122 decibel range which is 31-37 decibels louder than required in approved fire alarm systems. —**Falcon Alarm Co., Inc., Summit, N. J.** 244A

Electronic Controls

Use standard building blocks for low-cost, versatile systems.

A large percentage of industrial control problems now can be handled by electronic systems assembled from a series of 21 standard "building block" components. Cost of systems is one half to two thirds less than traditional made-to-order systems, it is reported.

Systems are set up merely by plugging-in units which can be expanded or regrouped by semi-specialist personnel. A single standard communications channel can be utilized to handle hundreds of control and supervisory functions.

Using the modular units you can assemble five standard control systems: automatic alarm, remote metering, discreet control, proportional control and transmission. Any plant electrician can install the completely integrated system.

Two main classes of systems may be provided using the Sparton modular units: completely automatic; and centrally controlled where a single operator can check the condition of a whole process by glancing at an integrated control panel.

The Sparton building-block technique is engineered to provide up to 125 channels of control. In a normal ten-channel system eight different functions can be controlled over each channel.—**The Sparks-Withington Co., Sparton Control Systems Div., Jackson, Mich.** 244B

Sound Analyzer

Combines functions of four separate instruments to solve noise problems.

Increasing concern with industrial noise problems has prompted the development of a sound analyzer that incorporates all essential functions in one instrument. The 20-lb. instrument takes the place of four individual units previously required to analyze noise.

Widest use of the instrument will be in the field of industrial noise prevention to combat occupational loss of hearing. As industry comes to realize that occupational loss of hearing is permanent and not recognizable in its early stages when hearing still could be partially saved by reducing noise, analysis will find increasing use.

The Soundscope meter measures over-all sound levels, measures sound in each of eight octave bands to determine noise peaks and checks sounds in narrower frequency bands. With the instrument, noise contour maps can be made of industrial areas, indicating unsafe locations. Sources of noise then can be modified to reduce the level of noise that they are generating.—**Mine Safety Appliances Co., 201 North Braddock Ave., Pittsburgh 8, Pa.** 244C

Tachometer Head

Measures speeds way down and way up.

Using a double-pole, double-throw switch in conjunction with a capacitor for its speed-sensing element this new line of tachometer takeoff heads measures speeds in two extreme speed ranges. The low range; from ½ to 100 rpm. The high range; from 5000 to 30,000 rpm. Claimed to have long operational life the ruggedly constructed unit eliminates brushes, slip rings and other regularly maintained and replaced parts.

A built-in gearing operates the speed-sensing element setting up a current exactly linear with respect to the speed when the takeoff shaft rotates in either direction. Extremely accurate readings are the result. Since they do not use generators these tachometers must be used in combination with the manufacturer's indicators. —**Merton Instrument Co., 432 Lincoln St., Denver 3, Colo.** 244D

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

WILSON DAM, part of the Tennessee Valley Authority, the spectacular engineering achievement that brought flood control and hydro-electric power to a large part of Tennessee.

SUCCESS BUILT ON FIRM FOUNDATIONS!

World's largest network of dams, the Tennessee Valley Authority is an example of success built on a solid base of engineering experience and high technical skill. The success of Esso Petroleum Solvents in the industrial field has the same kind of firm foundation based on years of research and technical experience. Continual testing to meet exacting standards assures the uniform excellence and character of Esso Petroleum Solvents. For detailed information, or technical assistance, write or call: Esso Standard Oil Company, Solvents Division, 15 W. 51st St., New York 19, N. Y.

ESSO

PETROLEUM SOLVENTS

RESEARCH AND EXPERIENCE DEVELOPED THE FINE CHARACTER OF ESSO SOLVENTS

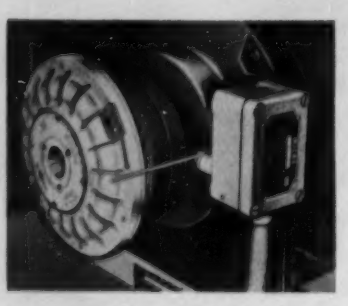
Agitator Drive

For slow speed where contamination of liquid must be avoided.

The new Little Giant agitator drive unit is recommended for stirring or agitating liquids slowly and positively without danger of contamination. It will meet rigid sanitary requirements set in food processing.

All bearings are pre-lubricated and sealed, so that no grease or lubricant of any kind can escape into the tank. Unit is driven by V belts reinforced with steel cable. Housing is cast aluminum; output shaft is stainless steel.

The Little Giant agitator drive unit is available to fit all standard agitators. — **Little Giant Products, Inc., 1600 North Adams St., Peoria, Ill. 246A**



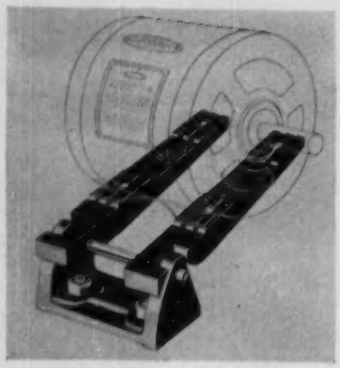
Thermal Cutout

Protects dry fluid drive against continuous overload.

Flexidyne dry fluid drive now can be protected against overheating by a thermal cutout device.

Inherently, the Flexidyne drive protects against instantaneous mechanical overload. Now, if an overload causes prolonged slipping and consequent heating of the Flexidyne, the thermal cutout trips the switch to cut off the power and give alarm.

Device mounts on the side of the Flexidyne. It contains a trigger spring, held down by an alloy thermal pin. When pin melts, the trigger springs out to push the non-sparking striker of the special switch to the off position. — **Dodge Mfg. Corp., Mishawaka, Ind. 246B**



Motor Base

Maintains tension under all load conditions, reduces wear.

A new inexpensive motor base automatically compensates for belt stress and maintains exact belt tension for all load conditions.

The greater the load, the greater the belt tension. Wear on both belt and bearings is reduced substantially, thereby.

With this base a motor operates quietly. Belts can be changed without disturbing the mounting. No maintenance is required for the base.

Designed for horizontally positioned drives, base is available in four NEMA frame sizes from ¼ to 7½ hp.—**Lovejoy Flexible Coupling Co., 4840 West Lake St., Chicago 44, Ill. 246C**

Variable-Speed Drive

Features all-around control and flexibility.

Tagged the Selectron, this new variable-speed drive brings to the market a unit packed with desirable features. Its speed range sweeps from 22 to 1 to 60 to 1.

A patented load compensating circuit is incorporated in the unit to afford close speed regulation, rapid speed response with stepless control. A tachometer feedback controls the speed within 0.0025%. And the drive can be installed with facility, maintained with ease.

Power supply is from a.c. single phase voltages of 110, 208, 220, 440 or 550 at 50 or 60 cycles. For other voltages separate transformers can be obtained. Standard optional features include dynamic braking, reversing and inching control. The drive motors are of the heavy duty, ball-bearing industrial type. — **Electro Dynamic Motor and Generator Div., General Dynamics Corp., Bayonne, N. J. 246D**

Non-Slip Belt

Transmits rotational motion more accurately than other methods.

A new-type non-slipping belt employs a herringbone-indexing design to transmit rotational motion with great accuracy. It works over the same range of ratios as gear drives.

The V-shaped tread of the belt tends to wedge continuously, centering the belt in the corresponding V tread of the gears. This allows the associated gears to be constructed without belt restraining rims.

Belt now is available only in a limited number of sizes, but production is planned for a variety of sizes. — **Kinevox Div., Electromation Co., Burbank, Calif. 246E**

Safety Controller

Cuts-off overloaded electrical conveyor systems.

This electro - mechanical safety controller instantly and automatically shuts off electrical conveyor systems at any predetermined load setting. Consequently it eliminates the need for shear pins, slip clutches and other mechanical safety devices often used to prevent damaging jam-ups from abnormal loading. In addition it can be rigged to signal, visually or audibly, impending trouble before cut-off point is reached.

A totally self-contained package the device measures and responds to deviations from normal loads over a wide range. Electric motors may also receive the protection of the unit's fine control.—**Tipp Manufacturing Co., Tipp City, Ohio. 246F**

WHERE PERFORMANCE IS VITAL...

KEL-F® fluorocarbon Oils, Waxes & Greases resist chemical corrosion and thermal breakdown

Kellogg has developed a series of oils, waxes and greases that exhibit outstanding resistance to corrosive atmospheres and temperature extremes. Based on the extremely stable trifluorochloroethylene polymer, KEL-F Oils, Waxes and Greases offer new answers to critical problems in plant operation and product manufacture.

Where and why these KEL-F fluorocarbon products are useful

Compressor Lubricants for high-pressure, high-capacity compressor systems—high thermal stability and chemical resistance combined with excellent flow and load-bearing characteristics.

Hydraulic and Pump Fluids—non-flammable . . . will not carbonize.

Heat Transfer Media—high degree of autoconvection.

Damping Fluids—high density (almost twice that of water) plus shear stability and non-oxidizing qualities.

Sealants and Lubricants for plug cocks and valves—heat stability; resistance to chemical attack, corrosion and gumming.

Visit the Kellogg Booth #804, 901. Plastics Exposition June 11-15. Coliseum, New York City

INTRODUCTORY OFFER

To familiarize you with the properties of these Kellogg products, we have made arrangements to offer you a trial one ounce tube of KEL-F #90 grease for $2.25 ppd. You'll find it effective in keeping stop cocks and other laboratory apparatus safely lubricated under the most corrosive conditions. Large quantities of 1 oz. and 3 oz. tubes can be ordered from laboratory supply houses. Use coupon below.

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- ☐ Send me 1 oz. tube KEL-F #90 Grease.
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- ☐ Bill me later.
- ☐ I'm interested in larger quantities of 1 oz. tubes. Put me in touch with supplier.
- ☐ Send me technical booklet covering KEL-F Oils, Waxes and Greases.

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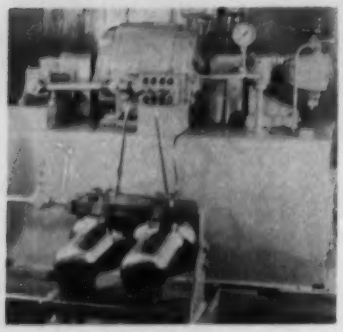
Spray Valve

Protected against scaling to prevent sticking of the stem.

A new non-scaling spray valve has valve stem and guide sealed against liquid to prevent scaling. It is suitable for feedwater heaters, deaerators, hot process water softeners, cooling towers, aerators, degasifiers and spray ponds.

Valve is constructed so that the valve stem, stem guide and valve spring are enclosed in a liquid-tight chamber. A special elastic sleeve permits free action of the valve, seals all moving parts from contact with the sprayed liquid. Seal withstands temperatures up to 450 F.—**Griggs Machine Co., Inc., Wallington, N. J.** 248A



Leakproof Pump

Operated hydraulically handles corrosive, abrasive slurries over wide range.

The Hydropulse hydraulic pump system is designed to handle corrosive and abrasive slurries. System is leakproof, delivers a flow substantially free of pulsation. Volume and pressure can be varied within design range while pump is running.

Pumping action is due to the alternate expansion and contraction of a hollow synthetic rubber pulsator within a pressure chamber. Expansion is obtained and controlled by oil forced into the pulsator by a positive-displacement high-pressure oil pump. Contraction occurs when internal pressure is relieved and the elasticity of the pulsator brings it back to original shape.

Amount of material pumped is controlled by regulating the delivery rate of the oil pump. Since the oil pump is a positive-displacement unit it reacts automatically to meet any increase in system pressure. A relief valve in the oil-pump discharge line protects against overpressure.

Pump has two pressure chambers operating out of phase to eliminate pulsation. Units are available to handle flows up to 70 gpm. and pressures to 3,000 psi.—**Scott & Williams, Inc., Pioneer Div., Empire State Bldg., New York 1, N. Y.** 248B

Flush Feeder

Handles concentrated slurries and corrosive liquids.

Small quantities of thin mud-like slurries or corrosive liquids can be fed into processes by a new flush feeder.

Device incorporates a unique check valve assembly so that the slurry being metered cannot enter the primary displacement cylinder of the metering pump. This valve assembly, which is separate from the pump mounts directly on the slurry tank.

Only water or system fluid passes through the reagent ends of the duplex Chem-O-Feeder pump. This fluid passes through the check valve assembly and aspirates slurry out of the tank into the line. The seats of the check valve assembly are flushed clean at every stroke. Flow can be controlled down to 0.75 gph.—**Proportioneers, Inc., 345 Harris Ave., Providence, R. I.** 248C

Centrifugal Pump

Operates efficiently over broader range of service conditions.

A new centrifugal pump, Model BL, offers the user more flexible pumping at high efficiency. Each size is said to handle a wider-than-usual range of pressures and capacities, will accommodate fluctuations in either pressure or capacity without serious loss of efficiency.

Pump has heavy duty ball bearings, lubricated at the factory. An extra-large shaft and strong supporting frame maintain perfect alignment. A trouble-free mechanical seal replaces the stuffing box.

Pump comes in 2, 3, 4, 5 and 6-in. sizes.—**Gardner-Denver Co., Quincy, Ill.** 248D

Plug Valve

Seating force applied manually, plug handles many materials.

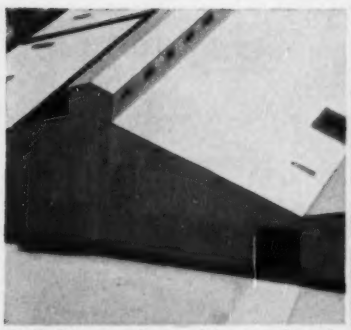
Departing from conventional plug valve construction the seating force on this plug is applied manually. Turning torque is kept low by dual handle design. Lower handle raises plug from its seat, upper handle adjusts for the desired flow. In this way friction and wear between the seat and plug is eliminated. Plug can be lowered again to give a positive seal, preventing any internal leakage.

Coated synthetic rubber plug requires no oil or grease to insure sealing or reduce friction. Consequence: No contamination of products passing through the valve. Abrasive slurries, solids in suspension, oil, gases and chemicals, therefore, can be efficiently handled. And for gases the rubber-to-metal sealing is superior to seals obtained from lubricated plugs.

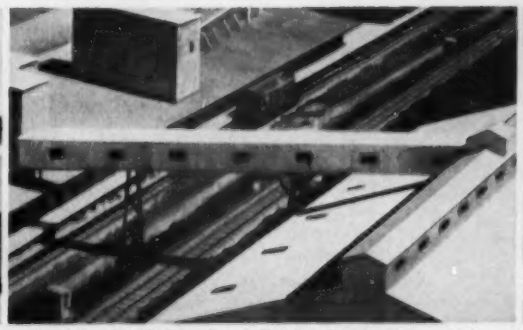
Built of semi-steel the valve's

Can standardized structures meet the custom requirements of a complex fertilizer plant? The answer proved to be "Yes, emphatically!"

WHY DIXIE GUANO COMPANY CHOOSES LURIA BUILDINGS

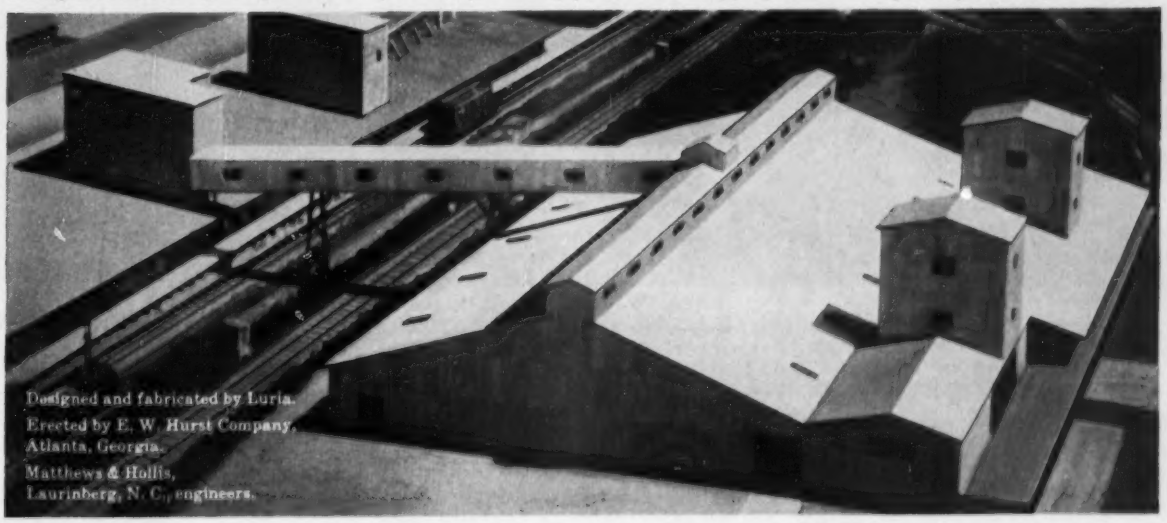


Bulk Storage Area with capacity of 12,000 tons of fertilizer can be filled during seasonal lulls by a single man.



Standardized Overhead Bridge by Luria contains conveyor belts that efficiently transport materials from the processing plant to the shipping center.

Multi-Story Buildups, adaptable to *individual* needs, house special processing machines.



Designed and fabricated by Luria.
Erected by E. W. Hurst Company, Atlanta, Georgia.
Matthews & Hollis, Laurinburg, N. C., engineers.

Luria unites high speed, low cost construction with the special design requirements of custom building.

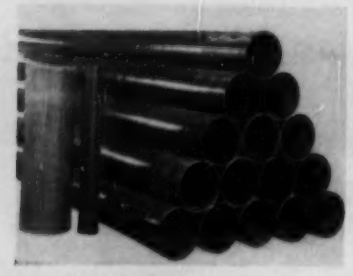
"Customized" to your *individual* needs, "standardized" to bring speed and economy to your expansion program—these are just two of the many advantages provided by Luria structures.

The list of Luria customers in the commercial fertilizer field is as impressive as the list of Luria advantages. Contact your Luria representative—*you'll find that it pays!*

LURIA ENGINEERING Company

511 Fifth Avenue, New York 17, New York • Plant: BETHLEHEM, PENNSYLVANIA
District Offices: ATLANTA, PHILADELPHIA, BOSTON, CHICAGO, WASHINGTON, D. C.

service range is upped by heavy flanges to 300 psi. In 3 in. size 3-way bodies are available. Other dimensions and styles can be built to order. — **Republic Mfg. Co., 15655 Brookpark Rd., Cleveland 14, Ohio. 248E**



Plastic Pipe

In wide range of sizes for pressure service on many liquids.

Now being offered for pressure service is a line of Fiberglas-reinforced pipe of epoxy and polyester resins. Pipe will handle most acid and alkali liquids and fumes, is being used economically in the oil, paper and chemical industries.

Valco pipe has a low friction factor and will not support the growth of fungi. It is light weight (6.5 lb. per ft. for 8 in. pipe) and can be installed easily. All that is needed is a standard reinforced Fiberglas flange or a slip-on sleeve which is cemented in place. — **Valco Corp., 1712 Roblyn Ave., St. Paul 4, Minn. 250A**

Wet Dust Collector

Transfers dust particles from air to suspended water particles.

Movement of air through the Ventrijet wet dust collector atomizes water and mixes it with the air stream to remove suspended dust particles.

Dust-laden air enters the collector and expands to reduce velocity. Heavy dust particles sink to the bottom of the tank. Air then moves through one or more venturi tubes into the discharge chamber. The low-pressure zone in the venturi throat induces water to enter the high-velocity air stream. As air and water mix, dust particles adhere to the water particles which are then removed by impingement separators.

Ventrijet is available in a range of capacities from 1,000 to 30,000 cfm. in single and double-row tube types.—**Pangborn Corp., Hagerstown, Md. 250B**

Control Valve

New features for standard model.

An improved version of a long dependable, standard control valve is now available. Among the new features: easier pressure range conversion by introducing a gasket seal at the diaphragm flange of the valve. The number of flange bolts has been decreased by 50% in order to save maintenance time on plumbing.

Retained from its original counterpart are the interchangeability of the internal working unit, the easily accessible interior and the built-in strainer.

The new valve is available in iron, bronze, steel and stainless steel bodies with bronze, stainless steel, Nitralloy and Monel trims. Screwed ends of the valve range from ¼ in. to 2 in.—**A. W. Cash Co., P.O. Box 554, Decatur, Ill. 250C**

Tube Fitting

Installs without disassembling, fitting is self-aligning.

A complete line of fittings, including unions, tees, elbows and connectors, tagged Self-align can be installed without disassembling. Tubing is merely inserted in the fitting until it bottoms and then the nut is tightened.

Self-aligning, as its trade name implies, the fitting is directed to low- and medium-pressure applications, especially instrumentation, where copper and aluminum tubing are used. Working on a dual-sealing principle, positive leakproof connections are assured.

Available fittings are brass in ☆ in. increments from ⅛ to ½ in. Aluminum Fittings can be obtained on a special-order basis.—**Weatherhead Co., Ft. Wayne Div., 128 West Washington, Fort Wayne, Ind. 250D**

Pipe Coating

Protects acid-carrying pipeline against damage and loss of fluid.

A reinforced plastic coating has been developed to protect high-silicon iron-alloy pipe against mechanical shock and damage. Also, it can withstand the corrosive attack of chemicals or fumes which might escape from damaged pipe or adjacent equipment. Initially, it has been used on a 4-in. transfer line carrying alcohol and strong sulfuric acid at 70 to 100 C.

Coating consists of a spirally wrapped glass-cloth tape bonded to pipe, fittings and valves with epoxy resin. Brush coating of resin is applied to surfaces cleaned by sandblasting. When resin has dried to a tacky state, glass cloth tape is wrapped around the pipe. Then

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

FOAMGLAS®

the cellular, stay-dry insulation

At the Baton Rouge Plant of Kaiser Aluminum & Chemical Corporation

Stay-dry FOAMGLAS insulation beats humidity, prevents corrosion on process tanks and vessels

Four years ago FOAMGLAS was installed on various process tanks and vessels at Kaiser Aluminum & Chemical Corporation's Baton Rouge, Louisiana plant. They needed a moisture resistant insulating material which could withstand high and rapidly changing humidity.

Because FOAMGLAS *stays dry* it was installed on hot water tanks and sodium aluminate process vessels varying in capacity from 2000 to 400,000 gallons. The moisture-proof structure of FOAMGLAS is giving *constant insulating protection* and is effectively preventing corrosion . . . despite the severe humidity conditions. Because it's fireproof FOAMGLAS is also providing an added safety factor.

These benefits and more can be *yours* when you insulate vessels, piping, equipment or buildings with long-lasting, *stay-dry* FOAMGLAS. Write for full details. We'll be happy to send you a free sample and our latest literature pertinent to your needs.

Pittsburgh Corning Corporation

Department H-56, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

You can easily prove that FOAMGLAS stays dry by making this simple test. It and five other equally simple tests will quickly demonstrate the combination of properties that make FOAMGLAS the perfect solution to your insulating problems. Write now for a free sample and complete testing directions.

Also manufacturers of PC Glass Blocks

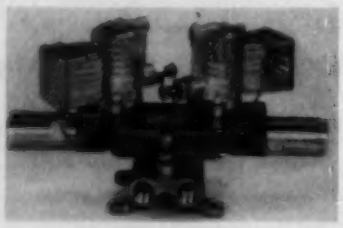
a second coat of epoxy resin is brushed well into the fabric and allowed to dry in the air until hard to the touch. Pipe is then cured in an oven at 90 C. for four to six hours.—**Bakelite Co., Div. of Union Carbide & Carbon Corp., 260 Madison Ave., New York 16, N. Y.** 250E

Diaphragm Valve

For remote control at almost unlimited pressures.

New diaphragm - actuated valve offers remote fluid-flow regulation at standard pressures ranging from 125 through 2,500 psi. And higher pressures can be handled if necessary. Operated by air the valve gives direct or reverse action with either single or double stainless-steel seats. Heightening its versatility is the valves ability to handle water, steam, air, gas, oil and other similar common fluids.

Available in cast-iron, cast-steel and stainless steel the valve bodies are styled straight-away or angle for both horizontal or vertical line installation. Various optional features are offered in the ¾ in. through 8 in. size range such as positioners, auto-locks, hand wheels and cooling fins.—**Copes-Vulcan Div., Blaw-Knox Co., Erie 4, Pa.** 252A



Solenoid Valve

New attachment insures positive centering of valve stem.

Driven by air a new attachment on double-solenoid valves insures positive mechanical centering of the main valve stem in the neutral position. It consists of stop plungers in extensions mounted at the ends of the valve body.

Operating without the use of mechanical springs that are apt to weaken or break the power-centered neutral prevents the main valve stem from drifting. Absence of springs allows the attachment to be mounted in any position. Teflon shock pads stop plunger travel. Full control of double-acting cylinders is the result.

Marketed on new double-solenoid valves of this manufacturer, kits are also available with which to install the attachment on similar valves now in service. The unit is completely self-contained.—**Valvair Corp., 454 Morgan Ave., Akron 11, Ohio.** 252B

Canned Pump

Completes prolonged run handling high-temperature liquid metal.

This mechanical liquid metal pump has just completed a successful 500-hr. performance run at more than 1,000 F.—claimed to be the highest temperature level at which a pump of this type has ever operated for an extended period. Production models of the pump for temperatures up to 1,600 F. will be applied to nuclear power plants, chemical process lines and other applications that require high-temperature heat-transfer mediums.

Pump is a new, hermetically sealed, canned-rotor design which incorporates pump and motor rotor in one integral unit. Unit is designed so that liquid temperature has little effect on the motor windings.

Unit shown is rated 150 gpm. at 285-ft. head. Other sizes range in capacity up to 5,000 gpm. — **Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.** 252C

Check Valve

Water hammer control at low cost for wide variety of liquids.

Meant to provide water hammer control in a durable unit at low cost this silent check valve operates effectively on a wide variety of hot and cold liquids—oils, gasoline, acids, chemicals, salt water and brine. Only prerequisite; that the flow be constant.

Featuring a removable and renewable disk and seat and a non-wear conical spring the valve is recommended for pressures from 125 to 2,500 psi. The valve can be furnished with special flange facings—male and female, ring joint, tongue and groove—and is available in sizes from 1 to 10 in.—**The Williams Gauge Co., Inc., 2 Gateway Center, Pittsburgh 22, Pa.** 252D

Centrifugal Pump

Delivers double capacity, at twice the head than possible previously.

Based on the manufacturer's long operational experience with pumps this centrifugal pump is engineered for a maximum 70% efficiency. This means double the head pressure and capacity for a given horsepower and size than had been previously realized.

A special design close couple between the pump and motor assemblies permits quick, easy seal replacement. And the new pre-set two-piece seal requires no further adjustments after installation. Constructed completely of stainless steel the pump is protected against corrosion and avoids product contamination.—**Bart Laboratories, 225 Main St., Belleville, N. J.** 252E

reach a new peak with YARWAY

in spraying efficiency non-clog nozzles

cone spray

Most popular design for cooling, recooling, washing, rinsing, air conditioning, drying and other spraying operations in industrial and processing work and in power plants.

Non-clog involute design has no internal parts (vanes or deflecting plates) on which foreign particles can collect. Special contour of nozzle body guides flow with minimum loss of energy towards discharge opening, where liquid attains maximum velocity and leaves nozzle in a fine hollow-cone spray.

Available in three types:

Bar-stock bronze (shown) for fine spray
Sizes ¼" and ⅜", male or female connection
Capacities up to 3 gpm; pressures 20 to 50 psi

Cast bronze Type B (shown) for air conditioning and small recooling systems
Five sizes, ½" to 1½"
Capacities up to 40 gpm; pressures 7 to 25 psi

Cast bronze Type C (not shown) for spray pond service
Sizes 2" and 2½"
Capacities up to 110 gpm; pressures 7 to 15 psi

Write for YARWAY Spray Nozzle Book N-617; it gives capacities, dimensions and application information.

fan spray

Preferred for many washing and cooling operations. Non-clog design, delivers flat fan-shaped sheet of spray with slicing action particularly desirable for surface washing.

Thin sheet of spray is discharged forward 30° from the vertical, spreading in fan shape up to 140°, depending on operating pressure.

Made of bronze, steel or other bar-stock metals, male thread, six sizes ⅛" to 1", capacities up to 7 gpm, pressures up to 50 psi.

Write for YARWAY Spray Nozzle Book N-617.

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY spray nozzles

Vibratory Feeder

Of electro-permanent magnetic type, is rated tops all-around.

This new type of vibratory feeder claims to offer tops in efficiency, durability and economy in obtaining highly controlled rates of various feeds. A simple electro-permanent magnetic drive delivers the high vibratory output.

Unit will operate directly from available 115 or 230 a.c. source without a rectifier. And the power input needed is relatively low.

Design eliminates the need for bearings and other friction-producing parts. Extremely flexible the feeder is adaptable to feeding, mixing, drying, cooling, packing, conveying and spreading of sizes from stones to powders.

Three available models of the vibratory feeder are able to move two, four or ten tons of dry sand per hour. Trays are available in a range of shapes made from both 16 gage steel or 16 gage Type 304 stainless steel.—**Eriez Mfg. Co., Erie 6, Pa.** 254A

Hot Material Conveyor

Withstands temperatures up to 1,400 F., will not burn through.

Even scorching chunks of metal as hot at 1,400 F. cannot burn holes through a new kind of rubber conveyor belt designed to handle hot materials.

Belt features Fire Curtain construction with two plies of glass fabric that float in the top rubber cover. The glass fabric retains its strength despite intense heat. If a hot object should drop on the belt the rubber cover would char only as far down as the glass-fabric heat barrier. Over-all strength of the belt and its cover is not impaired.—**Goodrich Industrial Products Co., Akron, Ohio.** 254C

Bulk Liquid Container

Now used for transporting polyvinyl acetate emulsions.

The Kaiser Nest-A-Bin bulk container now has been adapted by Shawinigan Resins Corp. to handle polyvinyl acetate emulsions. Holding 550 gal. the Nest-A-Bin is expected to reduce substantially customer in-plant handling costs. Faster delivery of emulsions is predicted, also.

Bin is manufactured of aluminum with upper and lower body sections joined at the center to form the assembled bin. When empty, the sections are separated and nested one within the other to save space.

A hose connection at the bottom provides for drainage. Bin is filled through 3-in. top opening. Pallet or fork truck can handle bin.—**Kaiser Nest-A-Bin Div., Kaiser Aluminum & Chemical Corp., Oakland 12, Calif.** 254D

Conveyor-Cooler

Pneumatic system cools and conveys powder before packaging.

A new line of cooling and conveying systems can reduce temperature of powdered products to 100 F. or lower prior to packaging.

Cool, clean air picks up the powder through a specially designed positive-acting valve. After cooling and conveying the powder to the packaging location the air is separated from the powder.

Powder leaves through a second air valve. Air returns directly to the processing or drying chamber.

Each system is designed and engineered to fit the job needs and is then fabricated as a package. Systems are sized for capacities up to 3,000 lb./hr.—**Henszey Co., Watertown, Wis.** 254E

Unloader Tilts Boxcar and Shakes Out Material

This unique Kar-flo unloader locks a 150,000-lb. railroad boxcar in its grasp and rocks out free-flowing bulk solids with a gentle oscillating motion. It is rated safer and faster than manual methods. Rocking motion produces a conveying action that moves the material simultaneously from both ends of the car toward the center. Because the car is tilted sideways eight degrees, the solids flow smoothly and continuously through the door into the receiving hopper below the unloader.—Link-Belt Co., 307 North Michigan Ave., Chicago, Ill. 254B

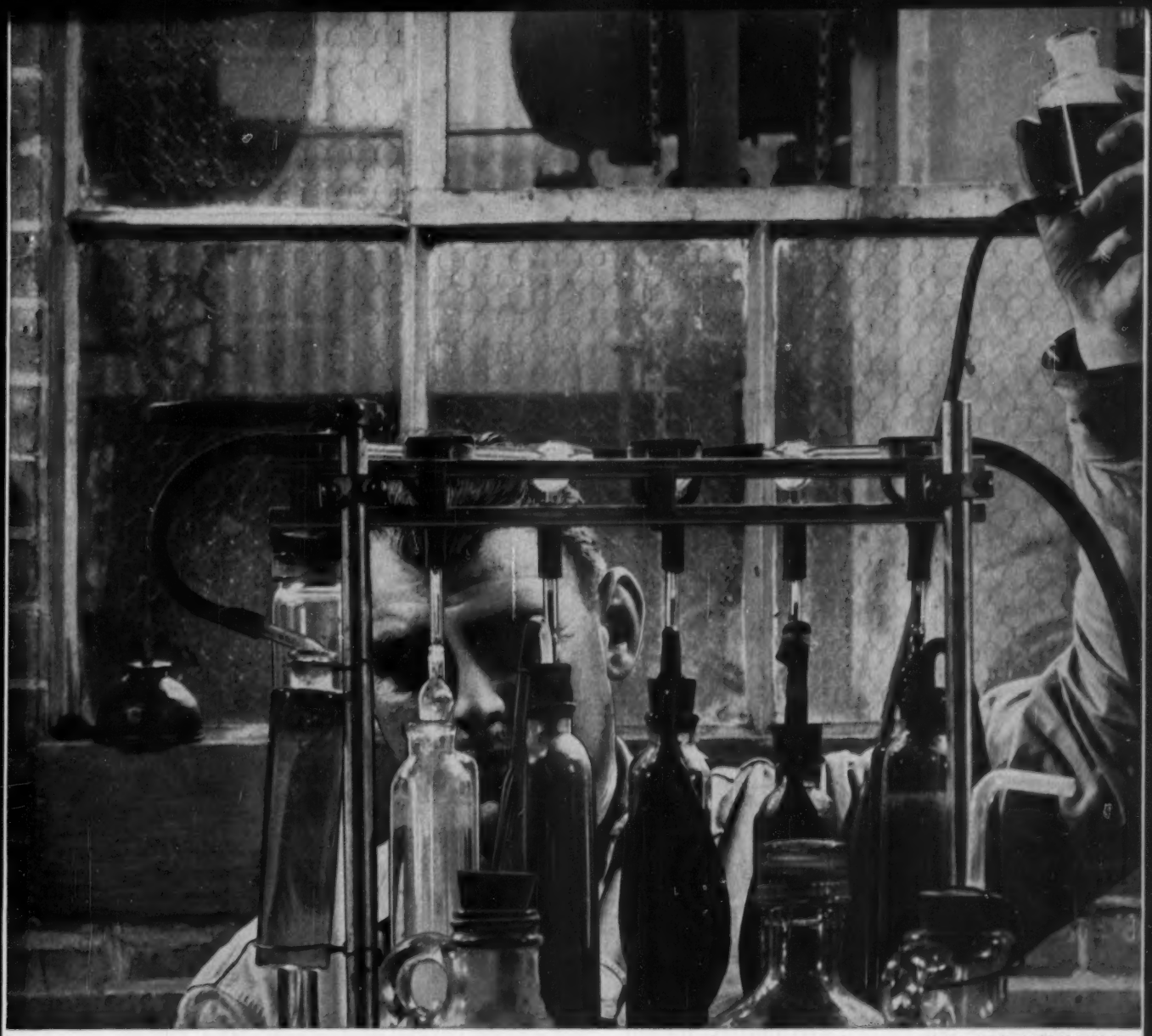


Photo courtesy Standard Oil Co., IN. J.

boost average ratings as much as 2 octane numbers *with the LJUNGSTROM® AIR PREHEATER*

With waste heat recovered and returned to the furnace in combustion air, the most modern heat-transfer systems can be operated at peak efficiency.

That's why you boost product quality with the Ljungstrom Air Preheater. Its heat-recovery efficiency makes possible advanced furnace designs that assure remarkably close control of processing. And finer control means a more uniform product . . . with average ratings as much as 2 octane numbers higher. One still's added income just from higher product quality is $58,000 annually.

How fast is "WRITE-OFF"?

In earnings from higher octane ratings, many refiners write off the cost of the Ljungstrom installation in less than two years. This time is cut to nine months and even less, when the other Ljungstrom advantages are taken into account – saves up to 20% in fuel costs . . . permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits obtainable in fuel burning equipment – call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

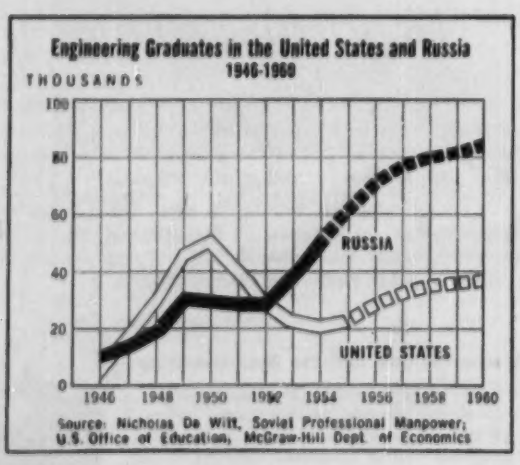
THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

Are We Losing the Race with Russia?

THERE is new confidence in the Kremlin. One key reason is expressed in a recent boast of Communist Party Secretary Khrushchev: **"The capitalists always regard our people as being backward, but today we have more engineers and more supporting engineering technical personnel than any capitalist country."** He promised that this lead would be widened and that communism would be victorious without war.

This boast cannot be dismissed as communist propaganda. Admiral Lewis L. Strauss, chairman of the U. S. Atomic Energy Commission, has warned: **"In five years our lead in the training of scientists and engineers may be wiped out, and in ten years we could be hopelessly outstripped. Unless immediate steps are taken to correct it, a situation, already dangerous, within less than a decade could become disastrous."**

This second editorial in a series on the shortage of scientists and engineers is designed to explore as carefully as possible the facts and the implications of the new emphasis on technical training in the Soviet Union. It draws heavily from the authoritative book *Soviet Professional Manpower,* prepared for the National Academy of Sciences and the National Research Council by Nicholas DeWitt of the Russian Research Center of Harvard and released recently by the National Science Foundation.



Trend Is Against Us

If the Soviet Union already has a lead in technical manpower, it is not very great. Both the United States and Russia now have around a million scientists and engineers. About a third of the Russian engineers were trained on inferior pre-1935 standards. **It's the trend — shown in the chart — that is alarming.**

Over the last five years we have turned out only 142,000 engineers, compared to an estimated 216,000 in Russia. In 1955 our output was around 23,000 compared to their 63,000. Over the next five years our projected output is 153,000, against at least 400,000 in Russia. There will be an additional 150,000 or more in the satellites and Red China.

In Russia, 30% of the college students are in engineering, compared to 8% here. Another 30% or more take degrees in natural sciences. Moreover, unlike ourselves, the Russians are

ploughing back a large proportion of their science graduates into teaching, which implies a rapid buildup in the future.

Quality As Well As Quantity

It would be foolhardy to assume that these new Russian graduates are inferior to ours in the quality of their technical training. They start out with much more intensive mathematical and scientific preparation at the high school level. They study harder and longer in college, with more laboratory work and more practical training. Their courses and textbooks seem to be as thorough as ours. Even though the Russian graduates may be overspecialized, they get results.

These results have been striking. The Russians developed both A-bombs and H-bombs faster than we expected, and it's not certain that they had to rely much on espionage. They pushed ahead of us for a while in jet fighter design, and they showed up with a fleet of long-range bombers well ahead of schedule. They are crowding us on nuclear power, electronics and automation. There are grave fears that they have established a lead in the vital field of military rockets.

The goal of Soviet scientific manpower policy includes not only weapon supremacy but also leadership of the neutral and uncommitted areas of Asia, Africa and the Middle East. The Soviet leaders may be bluffing in their offers to export capital, but they are preparing to export Russian scientific and technical know-how in a big way.

How They Do It

The Russians are determined to win the race for scientific supremacy, and they do not count the cost. **They pay their scientists and engineers salaries that seem fantastic when compared with other Soviet incomes.**

Senior professors, research scientists and top engineers are a major segment of the Russian elite. Their incomes are frequently six to ten times the average industrial wage. (In the U. S. six to ten times the average industrial wage would be $25,000 to $40,000 a year.) Housing and other privileges are correspondingly lavish. While preaching equality, the Soviets use capitalistic incentives far more boldly than we do. Indeed, practicing engineers and scientists have been complaining about the exalted status of professors and top research people, and salary scales are now being adjusted to give greater emphasis to practical results.

The Russians are also generous in their aids to education. Tuition has just been made free at all levels. Undergraduates receive 200 to 500 rubles a month and graduate students 800 rubles (about equal to an industrial wage) to cover living expenses. The biggest stipends go to science and engineering students. College students are deferred from military service, and engineers and scientists often enjoy continued deferment even after graduation.

Finally, the Soviet leaders can channel engineers and scientists — and all other human and material resources — into any area they choose. And the areas the Soviet leaders choose are predominantly those that contribute to military or political objectives, rather than to a better life for consumers.

What's Our Answer?

We are certainly not going to adopt Soviet methods. We do not want scientific robots, but free men, able to understand and add to our democratic heritage. At the same time, our world leadership in technology — and perhaps even our survival as a nation — will be threatened if we allow ourselves to lag far behind Russia in the training of scientists and engineers. Ways to keep the United States in the race will be discussed in a later editorial in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

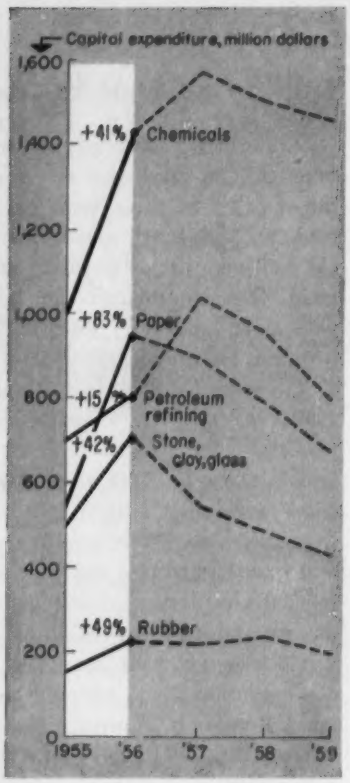
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

Capital Expenditures, Millions of Dollars

	1955* Actual	1956 Planned	'55–'56 % Increase	1956	1958 (Preliminary)	1959
Chemicals	1,016	1,433	41	1,576	1,513	1,468
Paper	518	948	83	891	784	666
Rubber	150	224	49	215	234	194
Stone, clay, glass	498	706	42	547	481	430
Petroleum refining	704	810	15	1,045	961	788
Chemical processing	2,886	4,121	43	4,274	3,973	3,546

*Dept. of Commerce, SEC, McGraw-Hill Dept. of Economics.



Chemical Processors: Eager With a Buck

Wondrous confidence in the economy's future—how else can you explain the supercharged spending plans for chemicals and other processing industries?

William H. Chartener, McGraw-Hill Dept. of Economics

This year chemical processing industries will spend 43% more than last year. For all manufacturing the planned increase this year is over 45%; for all U. S. business, 30%.

But that's just a starter. Even now, capital spending plans for 1957 in the CPI are higher than even the amazing 1956 plans. Chemical companies figure to spend more in each of the three years 1957, 1958, and 1959 than they intend to lay out this year. And the preliminary plans for all U. S. business call for nearly as breathless a level of spending in the next three years as the $39 billion ticketed for 1956.

Such is the incredible confidence exuding from the replies to McGraw-Hill's ninth annual survey of Business' Plans for New Plants and Equipment.

So large indeed are 1956's reported capital spending plans (there are big increases in nearly every industrial group) that they may prove physically impossible to carry out. Shortages of labor, materials, equipment and, perhaps, cash seem certain to block many projects. But capital spending not completed this year is likely to be added to impressive budgets already scheduled for 1957.

▶ **New Products Mushroom**—Chemical firms are taking the lead in capital spending for new products. When this year's McGraw-Hill survey asked manufacturers "Will a significant part of your 1956 expenditures for new plant and equipment be for facilities to make new products?," chemicals led all industries by a big margin, as 61% of the replies said "Yes."

In other process industries, where production is more concentrated in standard items, fewer companies reported significant spending to make new products. The "yes" percentages were as follows: Paper, 22%; Rubber, 38%; Stone, clay and glass, 14%; and Petroleum refining, 28%.

For all manufacturing industries, 28% of the companies said a significant share of 1956 expenditures would be for new product facilities.

▶ **New Products Sell Like Crazy**—Another question posed was: "Roughly, what percent of your 1959 sales do you think will be in new products (either products not produced in 1955 or products sufficiently changed to be reasonably considered as new products)?"

On this query, only chemicals, among the five process industries, rated above the average for all manufacturing—15% for chemicals against all-manufacturing at 11%. Here's how other process industries estimated new product percentage of their 1959 sales: Paper, 8%; Rubber, 9%; Stone, clay and glass, 6% and Petroleum refining, 4%.

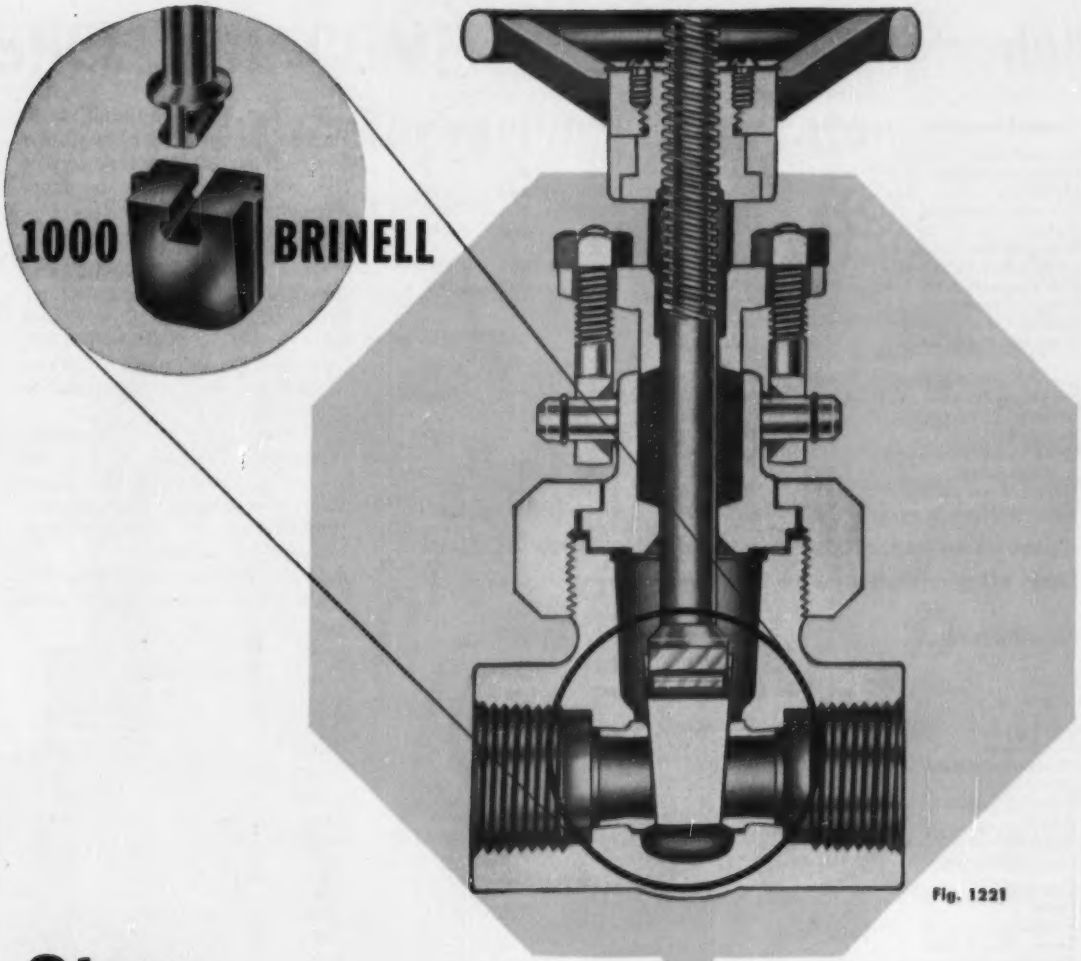


Fig. 1221

Stop Galling with the hardest valve wedges you can buy

Highly resistant to erosion and corrosion

Here's a wedge as hard as flint . . . so hard that it's undamaged by pipe cuttings, scale or grit. It's the only trim we know of which will successfully withstand the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling. This wedge is *13% chrome stainless steel hardened up to 1000 Brinell.*

Specify the OIC 1221 gate or 1621 globe where you need the extra rugged nature of forged steel. They are recommended for steam service up to 800°F...oil service up to 1000°F. Or, use these same valves for hydraulic service up to 2000 lbs.

Write for Form 195 for specifications on the OIC forged steel line.

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

U. S. Business Capital Expenditures—Millions of Dollars

	1955* Actual	1956 Planned	'55-'56 % Increase	1957	1958 Preliminary	1959
Chemical processing	2,886	4,121	43	4,274	3,973	3,546
Iron and steel	879	1,600	82	1,584	1,331	1,171
Nonferrous metals	293	653	123	986	454	236
Machinery	809	1,092	35	902	844	828
Electrical machinery	436	528	21	544	506	450
Autos	1,128	2,041	81	1,654	1,042	1,042
Transportation equip. (including aircraft)	274	397	45	318	251	233
Other metalworking	729	1,059	45	973	949	842
Food & beverages	718	802	12	764	685	659
Textiles	366	381	4	343	310	313
Misc. manufacturing	922	1,324	44	883	807	855
All manufacturing	9,440	13,998	48	13,225	11,152	10,175
Petroleum industry†	4,288	4,732	10	4,881	5,033	5,166
Mining	318	427	34	325	331	302
Railroads	923	1,495	62	1,136	1,022	991
Other transportation and communication	3,403	4,526	33	4,586	3,972	5,048
Electric & gas utilities	4,309	4,968	15	5,459	4,763	4,413
Commercial	7,349	8,819	20	8,466	7,873	7,479
All business	30,030	38,965	30	38,078	34,146	33,574

*Dept. of Commerce, SEC, McGraw-Hill Dept. of Economics. †Non-processing expenditures.

New Products . . .

	Will much be spent in '56 to make them?	How much will be sold in '59?
	Percent of Companies Answering Yes	% from New Products[1]
Iron & steel	6	7
Nonferrous metals	25	6
Machinery	25	19
Electrical machinery	44	18
Autos[2]	50	...
Transportation equipment (including aircraft)	31	20[3]
Chemicals	61	15
Paper	22	8
Rubber	38	9
Stone, clay & glass	14	6
Petroleum refining	28	4
Food & beverages	22	8
Textiles	23	13
All manufacturing	28	11

[1]New products are defined as either products not produced in 1955, or products sufficiently changed to be reasonably considered as new products.

[2]Includes new types of cars and trucks (but not style changes in existing types) and also new types of engines, parts and accessories.

[3]Includes shipbuilding and railroad equipment.

Research and Development Spending, (Millions of Dollars)

	1953[1]	1955	1956	1959
Primary metals	59.8	75.3	89.6	113.0
Machinery (including electrical)	1,097.2	1,357.7	1,561.3	1,757.0
Aircraft and parts	758.0	1,038.5	1,152.7	1,267.0
Fabricated metal products & ordnance	103.3	134.3	147.7	163.8
Professional & scientific instruments	171.7	185.4	194.7	259.6
Chemicals	361.1	440.5	480.1	559.4
Paper	27.9	36.3	41.0	49.4
Rubber products	53.6	65.9	69.2	86.3
Stone, clay & glass	38.0	46.4	54.8	65.0
Petroleum products	145.9	170.7	184.4	201.4
Food and kindred products	54.2	66.7	72.0	84.7
Textile mill products & apparel	28.0	32.2	33.5	37.7
Other manufacturing[2]	604.1	863.9	1,131.7	1,356.3
All manufacturing	3,502.8	4,513.8	5,212.7	6,000.6
Nonmanufacturing industries	196.6	253.5	275.6	317.0
All industries	3,699.4	4,767.3	5,488.3	6,317.6

[1]National Science Foundation.

[2]Includes autos, tobacco, lumber and wood products, furniture, printing and publishing, transportation equipment other than aircraft and autos, and miscellaneous manufacturing industries.

Textiles, evidently banking on further success with synthetic fibers, reported that they expect 13% of 1959 sales to be from new products.

▶ **All Sales Head Up**—Chemical companies top all industry also in optimism over long-range sales prospects. By 1959 they expect sales to be up 39% over 1955, compared to an average pickup of 24% expected by all manufacturing firms.

For this year alone, chemical companies forecast a 9% increase in sales over 1955. (These figures represent physical volume and take no account of possible price changes.)

Other process industries, too, show optimism in their sales forecasts:

Sales Will Soar

	% Increase '55–'56	% Increase '55–'59
Chemicals	9	39
Paper	9	31
Rubber	4	21
Stone, clay, glass	9	27
Petroleum refining	5	17

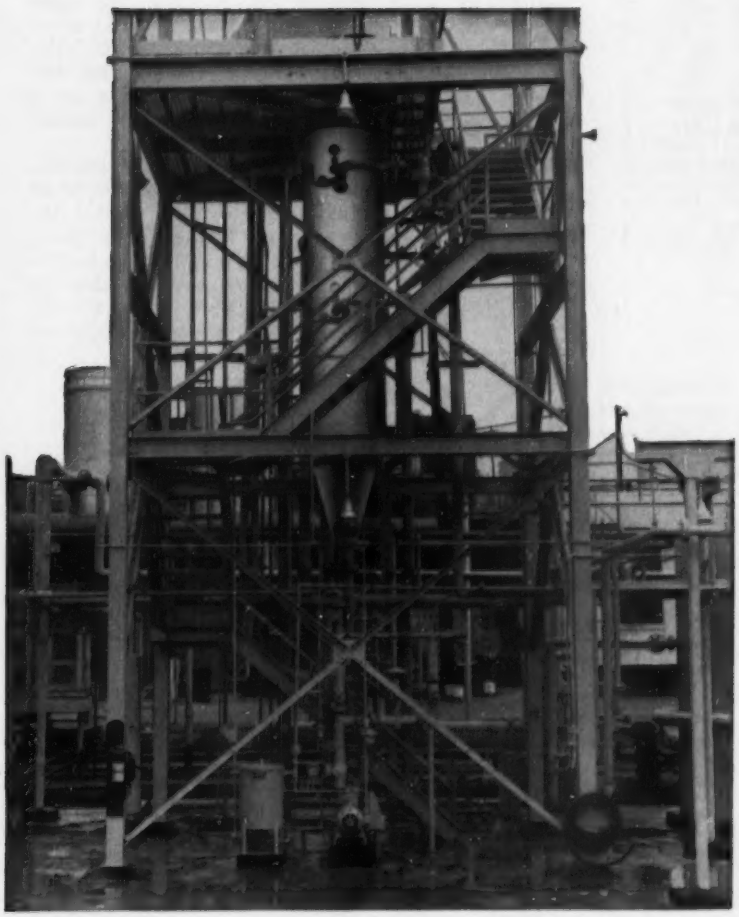
▶ **Need More Capacity**—This year's industrial capacity figures have a new base—1950 = 100—which indicates the rise in the production capacity of American industry since the beginning of the Korean War.

Chemicals have been outstripped somewhat in percentage of growth since 1950 by the metalworking industries, particularly transportation equipment. But chemical companies top all manufacturing industries in expansion planned between 1956 and 1959.

By the end of 1959, chemical companies expect their capacity to be 29% higher than at the end of this year and more than double (114% higher) the chemical producing capacity of 1950. For all manufacturing industries, the looked-for 1956-59 increase is only 18%, and the over-all rise from 1950 to 1959 only 78%.

Petroleum refining capacity is scheduled to rise 10% in the three years 1957-59, with an increase for the decade 1950-59 of 43%. Other process industries—paper, rubber, and stone, clay and glass—all expect to have nearly twice as much ca-

SHELL OIL COMPANY solves scaling problem with Turba-Film Evaporator



Turba-Film Evaporator used by Shell Oil Company, Martinez, California, dries a special type of oil, eliminates scale formation on heat transfer surfaces and provides continuous operation. The Turba-Film Evaporator shown is a No. 5 model built to Shell's specifications with stainless steel rotor, vapor section and outlet cone. It processes 30 barrels of oil per hour.

The problem:

to reduce moisture content of a special type of oil from an initial content of 3 to 6% to a maximum of 0.2%. Standard stills achieved the specified moisture content but deposited inorganic salts as scale on the heat transfer surfaces in such quantities as to demand frequent shutdown for cleaning.

The solution:

the Turba-Film® Evaporator, now in use for over a year, reduces 30 barrels of oil per hour to the specified moisture content – usually even lower – and precipitates the scale-forming substances in the dried oil, from which they are easily filtered. Shell now enjoys continuous operation in this process without shutdown for cleaning.

The patented Turba-Film Evaporator and the Rodney Hunt-Luwa Spray Dryer have a broad range of moisture-removal application in the Chemical Process Industries. Send for informative literature on Rodney Hunt process equipment.

RODNEY HUNT MACHINE CO.
Process Equipment Division
31 Vale Street, Orange, Massachusetts, U. S. A.

RODNEY® HUNT

Capacity . . .

How Much Will Industry Expand?*

	In Place		Planned		Percent Increase		
	1954	1955	1956	1959	'54–'55	'55–'56	'56–'59
Iron & steel	119	123	127	149	3%	3%	17%
Nonferrous metals	144	154	166	212	7	8	28
Machinery	143	153	167	200	7	9	20
Electrical machinery	150	162	177	211	8	9	19
Autos	140	151	163	192	8	8	18
Transportation equipment (including aircraft)	181	195	211	234	8	8	11
Other metalworking	118	126	139	164	7	10	18
Chemicals	**142**	**152**	**166**	**214**	**7**	**9**	**29**
Paper	**130**	**139**	**153**	**194**	**7**	**10**	**27**
Rubber	**132**	**144**	**156**	**184**	**9**	**8**	**18**
Stone, clay & glass	**134**	**142**	**153**	**181**	**6**	**8**	**18**
Petroleum refining	**122**	**126**	**130**	**143**	**3**	**3**	**10**
Food & beverages	117	122	128	142	4	5	11
All manufacturing	131	140	151	178	7	8	18

*Index of Industrial Capacity (1950 = 100)

pacity in 1959 as at the start of the Korean War.

And this added capacity is sorely needed if the chemical process industries are to meet the expected increases in demand over the next four years. Indeed, all the process industries say they are even now pushing against their capacity.

In last year's McGraw-Hill survey, companies were asked at what percent of capacity they preferred to operate for efficient production. These preferred rates, together with the actual operating rates at the end of 1955, are given below:

Operating Rates Strain Capacity

	% of Capacity	
	Preferred	Actual
Chemicals	92	90
Paper	97	100
Rubber	90	91
Stone, clay, glass	88	94
Petroleum refining	91	96

In every process industry save chemicals proper, more capacity is needed just to bring operating rates down to preferred rates, let alone make provisions for increased sales. Even in chemicals, the margin of reserve capacity is slim.

▶ **No Brake on Research**—Chemical process companies account for about 15% of all the research and development expenditures of American industry. And they expect to keep pace with the growth in these expenditures by industry in the years ahead.

Total research and development costs of American industry this year will be about $5.5 billion, up from $3.7 billion in 1953 and about $4.8 billion last year. Although preliminary plans call for an increase to only $6.3 billion by 1959, it seems more likely that the rate of growth of the last few years will continue. The 1959 tab could, in fact, be 50% higher than 1955's.

The research figures in this year's McGraw-Hill survey are the first information ever compiled on industry's *plans* for research and development spending. They are comparable to data for the year 1953, published last year by the National Science Foundation.

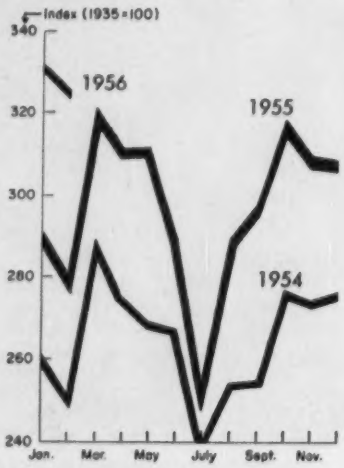
Though these figures, particularly those for 1959, reflect preliminary plans, their general implication is dramatically clear: The increasing volume of research means a continuing flood of new product developments and high capital expenditures to take advantage of these developments (one explanation for industry's plans to invest more in the next four years than in any similar period before).

▶ **Keeping the Boom Booming**—Last year's survey indicated that the rising trend in capital expenditures, halted briefly in 1954, would carry far beyond 1955. Preliminary estimates given even then pointed to a new surge of industrial expansion.

This year's survey firms up the optimism of last spring. For U. S. industry as a whole, capital expenditures plans now call for larger investment in new plants and equipment in each of the four years 1956-59 than in the record year of 1955. The same is true of every chemical processing industry except the ceramic group (stone, clay and glass), where 1959 plans are a little below actual 1955 spending.

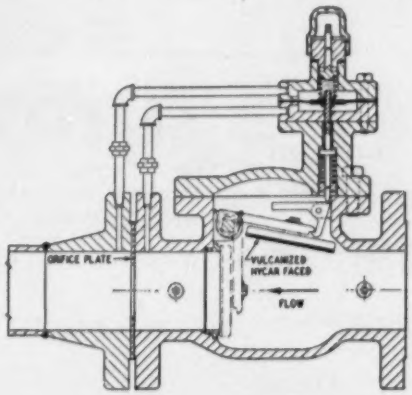
And once again, there was a tendency for companies in all industries to plan capital expenditures further in advance. The number of firms able to give specific plans as far ahead as 1959 was 88% of the total sample, the greatest percentage ever.

Chemical Consumption

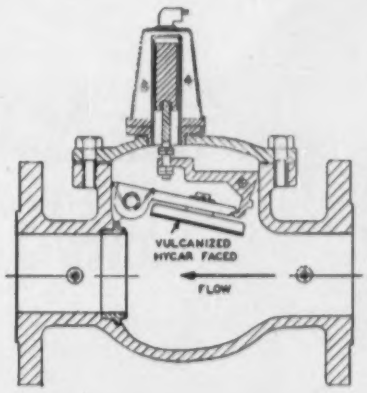


Consumption by Industries

	Feb. (Final)	March (Est.)
Coal products	11.8	12.5
Explosives	9.0	10.1
Fertilizer	81.4	83.5
Glass	25.0	26.2
Iron & Steel	18.6	20.0
Leather	4.5	4.2
Paint & varnish	29.4	31.6
Petroleum refining	30.4	31.9
Plastics	29.3	30.8
Pulp & paper	36.9	38.9
Rayon	30.2	31.5
Rubber	7.1	7.3
Textiles	11.2	11.1
Total	**325**	**340**



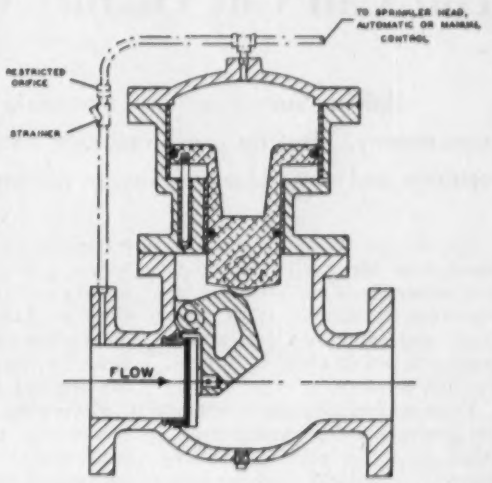
Model 1200. "Sentry" ***excess flow valve*** *automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.*



Models 1700 and 1800 "Sentry" ***solenoid shut-off valves*** *operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.*

"Sentry" valves are full flow valves, *for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.*

Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



Model 3000 "Sentry" ***piston operated quick-opening valve*** *opens instantaneously when the pressure above piston is released. Ideal for deluge systems — and for remote opening and closing of fuel line.*

Now Coppus brings you "Sentry"® Valves for automatic protection

These valves are *patented* quick-closing latch type and quick-opening piston type. All are full flow valves.

Latch-type "Sentry" valves are widely used in the chemical, petroleum and gas industries for closing automatically and instantaneously gas, process and fuel lines. The piston type valve can be automatically or manually opened and closed from any remote location. It is ideal for deluge systems, operates instantly; closing of this valve is against the flow, eliminating water hammer.

Sizes run from 1½" to a full 8". For full information send for Coppus Bulletin 500 to Coppus Engineering Corporation, 227 Park Avenue, Worcester 2, Massachusetts.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

LOOK FOR THE BLUE BAND THAT IDENTIFIES COPPUS QUALITY

How Quality Control Adds to Raw Material Costs

TYPICAL EXAMPLE		
	Invoiced value	$1,000
	Storage, warehousing	30
	Quality Control	22

You Can Cut Quality Control Costs — Safely

Making sure your raw materials are up to snuff costs money. But do you know how much? Here's one estimate and some ideas on how to economize safely.

Maybe you think the cost of controlling the quality of your raw materials is not your cup of tea—that it doesn't affect you much and/or there's really not much you can do about it in production, anyway.

You may feel this way whether the production department itself takes an active part in quality control (regularly checks raw materials in its process control lab) or relies on the company's central labs for this service.

But just as surely as production helps pay the salaries of the clerks in the accounting department so does it help bear the cost of raw material quality control—in its raw material costs and eventually in its production costs.

These control costs are not chicken-feed. And you in production can, either directly or by influence, do something about them.

First, you've got to be sure what the tab is and where it comes from. Usually these costs are obscured in general overhead or lumped in over-all processing quality control. Even if raw material quality control costs are segregated they may not be broken down for specific materials.

▶ **Higher Than You Think**—A recent survey of raw material quality control costs, by Warner-Chilcott Laboratories, Division of Warner-Lambert Pharmaceutical Co., has come up with an eye-opening answer.*

Reviewing all the material received and checked during the year (2,632 lots), Warner-Chilcott found that 2.2% of raw material invoiced value, on the average, went to quality control. In other words, to every $1,000 (invoiced value) of raw material received and warehoused $22 must be added to cover the cost of checking its quality.

Warner-Chilcott also surveyed, on an individual basis, 154 lots of raw materials, including 79 different products from 54 suppliers. Figuring labor and overhead costs as percentages of invoiced values, the survey reports raw material quality control costs ranging from 0.2% to more than 60% of invoiced value (see table).

Moreover, W-C found that raw materials claimed 40% of the total quality control bill and came to two thirds of the company's allowance for warehousing overhead ($30).

▶ **Rejections Hurt**—Material rejections proved quite expensive. Warner-Chilcott rejected 37 of the 2,632 lots received during the year—a rate of 14/1,000 lots examined. Value of these raw materials was 2.8% of the total cost of raw materials purchased that year. The eventual control cost—because of these rejections—was 6.5% of invoiced value or three times the annual average.

▶ **Pointing the Way** — Admittedly, these survey results are only approximations and may not apply at all to your business. They do reveal, however, raw material quality control as an expense to be reckoned with, and could pin-point certain chemicals demanding inordinate amounts of quality control. As Warner-Chilcott's Sondern puts it, "A survey like this helps make both

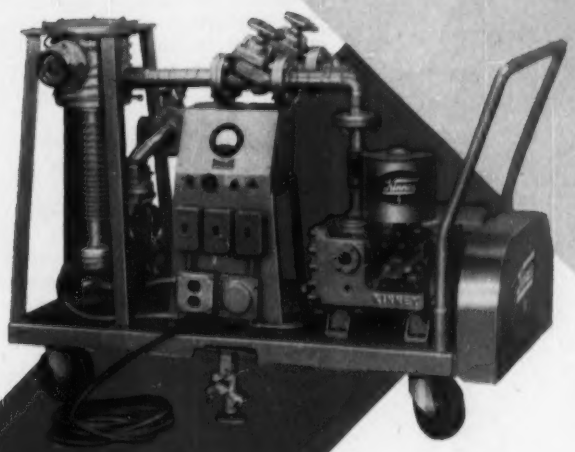
Quality Control Costs Vary

Raw Material	Percent of Invoiced Value
Mineral oil, 4,000 gal	0.2
Ferrous sulfate, 150 lb	44.5
Sodium bicarbonate, 12,000 lb.	1.8
Calcium carbonate, 1,500 lb	9.8
Senna leaves, 20 lb	65.0
Ground ginger, 130 lb	17.2
Oil of peppermint, 20 lb	8.6
Sugar, 20,000 lb	0.3
Corn starch, 10,000 lb	1.5

* Dr. Clarence W. Sondern, Warner-Chilcott's quality control manager, discussed this survey at a meeting of the American Pharmaceutical Manufacturers Assoc. in New York City. This CE story was suggested by Dr. Sondern's remarks.

MOBILE VACUUM...

new Kinney® mobile high vacuum unit offers efficiency, flexibility!



The new Kinney Mobile High Vacuum Unit is ideal for any experimental, pilot plant, or production application where a compact, mobile station is required. This mobility feature is vital in more and more operations to cut down installation time and materials. Basic design components include: a Kinney KC-15 roughing and backing pump, a 4" fractionating diffusion pump with 4" baffle valve, and a Kinney KC-2 holding pump. These are mounted on a fabricated base having tubular handle, swivel casters, and caster lock . . . together with a 3 station thermocouple gauge (Ion gauge-TC gauge instrumentation optional) and a central control panel. Only utility requirements are cooling water for diffusion pump and single phase 110 volt power supply (extra long service cord supplied with unit).

Complete operational data and performance curves are available upon request. For full details contact any of our competently staffed district offices . . . in Baltimore, Charleston, W. Va., Charlotte, Chicago (La Grange), Cleveland, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and The International Sales Office, 90 West St., New York 6, N. Y.

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• Please send complete data on the new Kinney Mobile High Vacuum Unit.

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the supplier and user of raw materials more quality control cost-conscious."

▶**Cut Out Testing?**—Now, obviously, these costs can be shaved by merely decreasing surveillance of incoming raw materials. Just cut down on testing.

Few will argue that this would not be the riskiest form of "economy." Even though your raw material gets the most exacting scrutiny from the supplier's laboratories, you can't be sure you're getting what you've bargained for.

Suppose a material is incorrectly labeled? Suppose a chemical's properties change in transit? Ten dollars of the "wrong" raw material can poison $10,000 worth of finished goods.

▶**Save in Safety**—No, there are ways to cut control costs without relaxing vigilance. Most remedies hinge on sharpening up two things:

• Buying habits — erratic, inconsistent scheduling and "cheap" goods are costly burdens to production.

• Liaison between departments — everyone, production, purchasing, quality control and supplier, should understand the factors that affect quality control costs.

▶**Make it in Round Lots**—As a general rule, it's a good idea to make all purchases in round lots. The fewer the number of different lots of a single commodity, the less control work is needed by the buyer. Such a simple (but often-neglected) thing as ordering 1,000 lb. of raw material from one lot rather than two, cuts quality control testing in half.

Urge your purchasing department to make notes in their records of the standard size of lots, packaging units and similar data.

Warner-Chilcott finds suppliers are usually willing to accommodate a buyer, provided selection of particular lots doesn't run up the suppliers' costs.

Before the purchasing department decides how to divide your orders, for a particular raw material, among various suppliers, it should consider the sizes of the unit lots each can give you. The bigger the lots, the fewer the lots needed to cover your requirements, and so forth.

Suppliers have even been known to swell lot sizes for raw material purchasers by, for example, carefully blending two or more conventional lots.

▶**Cheap and Expensive** — Be wary of the cheaper brand or grade of raw material. It may prove more costly—after you add in the extra surveillance needed and possible rejections—than the more expensive stuff you've been using. Know the control costs involved before specifying or purchasing any item.

Try to get samples of material that's either new or from a new supplier checked before shipment. It's costly to reject something after it's in your warehouse.

▶**Liaison Enlightens** — Make sure purchasing and quality con-

Location Factors	Percent Who Consider Factor Important
Availability of product markets	82
Wages and salaries	81
Abundance of general labor supply	79
Availability and cost of raw materials	78
Labor's will to put out a full day's work	78
Workers' happiness and well-being	78
Cost of transportation of products to principal markets	76
Cost of transportation of raw materials	75
Abundance of skilled supervisory and professional labor	75
Cost of living	75
Time required for delivery of products to principal markets	75
Cooperativeness of other business people	74
Availability of building sites	75
Climatic conditions	73
Hospital, sanitation, education, and welfare facilities	73
Time required for delivery of raw materials	72
Availability and cost of utilities	72
Plant rental or construction costs	72
General living conditions for key personnel	71
Insurance rates	71
Availability of business credit	70
Availability of business information	69
Labor laws	69
Taxes	69
Recreational facilities	68
Availability of risk capital	67
Labor unions	65
Time required for delivery of machinery, equipment and supplies	62
Cost of transportation of machinery, equipment, and supplies	61
Competence and stability of state and local government	61
Availability of prime contractors	58
Editorial policy, news coverage, circulation of newspapers	57
Availability of subcontractors	55
Subsidies or other incentives by state or local groups	45

What Factors Influence Plant Location?

What factors do you consider important in deciding where to build a plant? This is a question put recently to over 500 manufacturers who located in the Southwest after World War II. The Business Executives Research Committee of the University of Oklahoma Business Research Center asked the questions and the results are above.

Thirty-four location factors are listed in order of the frequency of their mention. The percentage figures indicate what portion of the manufacturers queried think a particular factor is important. This data was first published in the Oklahoma Business Bulletin.

Where low odor is a factor

use these SHELL SOLVENTS

These solvents are recommended for low odor and odorless products.

Detailed specifications of these Shell Solvents are contained in booklet shown. It will be mailed on request.

SHELL SOL 71 AND 72

. . . have no odor, are ideal for interior finishes, polishes and cleaners.

SHELL SOL 140

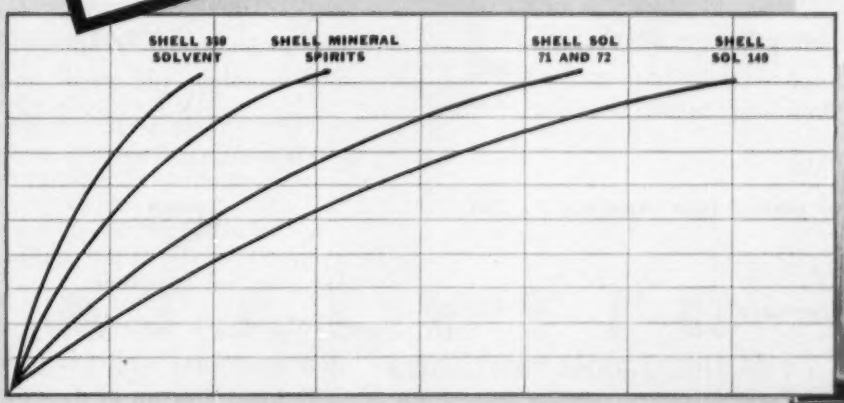
. . . a slow drying, high boiling, high flash point solvent with a very mild odor.

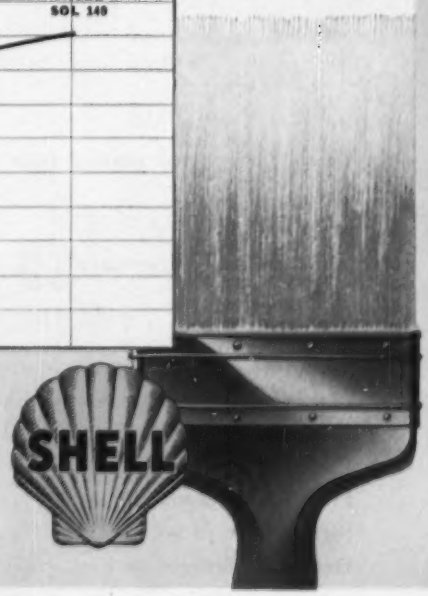
SHELL 360 SOLVENT

. . . faster evaporation, low odor.

SHELL MINERAL SPIRITS

. . . conventional distillation range, solvent power and drying. Mild odor.





SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK

trol are fully aware of the qualities in raw materials that are incompatible with your processing—and what properties are of lesser importance. They can buy and test more efficiently with your specific needs in mind.

Help the supplier appreciate the reasons behind the raw material specifications confronting him. By judicious selection from his finished goods, he may be able to send materials more closely fitting your specific requirements.

Plan your raw material orders as far ahead as possible and let purchasing and quality control know of your plans. There'll be less need, then, to go out at the last minute to scrounge chemicals from any source and of any quality (this means plenty of testing) to tide you over.

GUIDED TOUR CONTINUED

PICTURED FLOWSHEET

New Filters for Phosphoric Acid 314

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Design of orifices to limit pipe flow . . . . . Oct.

New filters for H_3PO_4

Long out hunting, engineers finally bagged their prize with a new design. Now tray filters get continuous gypsum-H_3PO_4 separation in wet-process phosphoric plants; beat blinding, use little water, handle hefty feeds. (p. 314)

Talent on parade

Biographies and backgrounds of your authors add weight and importance to their contributions in this issue. (p. 344)

New technical literature

You can get—free and fast—literature on any subject in your field. Keep files up to date the easy way. (p. 410)

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Inside Back Cover

Operating plants are today proving the worth of Catalytic's ability to design for profit.

Pioneering achievements in such diversified fields as metallurgy, petroleum, chemicals, and petrochemicals are recorded in concrete and steel.

The skill, creative ability, and experience of Catalytic's personnel, alone or supplementing the engineering forces of your own organization, can create the kind of plant that will produce profits for you.

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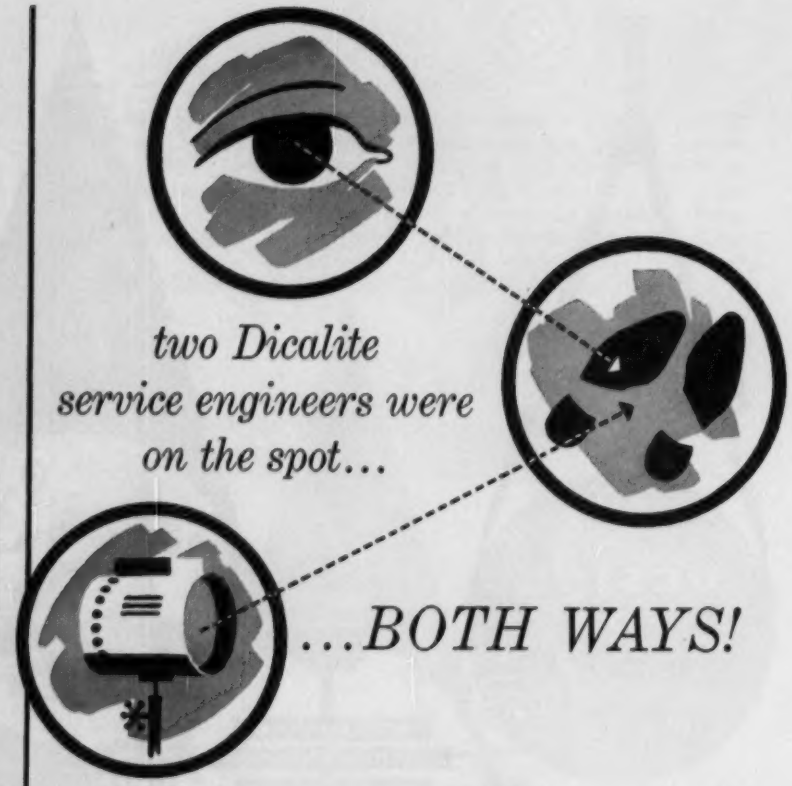
CATALYTIC *ON-TIME*... *ON-BUDGET* SERVICES
for the metallurgical, chemical, petrochemical and oil refining industries: Project Analysis; Process Development; Process Design; Economic Studies; Engineering; Procurement; Construction; Plant Operation

FILTRATION ENGINEERING —SCIENCE OR ART?

The life of a Dicalite filtration engineer is complicated. He spends much of his time running tests so that he will be able to recommend to a plant or laboratory the optimum grade and dosage of filteraid to attain satisfactory clarity in their particular process liquor. Yet hardly ever can the process engineer of such a plant define the degree of clarity desired in terms of properties which can be precisely measured in a laboratory. Further, the particulates removed by diatomaceous filteraids such as Dicalite are usually of a complex nature, complicated chemically, and troublesome because, as a general rule, their physical characteristics and particle size distribution are unknown. Consequently, when the filtration engineer begins his tests, he is working on the difficult problem of selecting the optimum filteraid without knowing exactly what he is trying to remove, or what precise degree of clarity is required. This explains why filtration engineering is commonly called an art. No mathematical equations for the prediction of clarity exist, despite many years of filteraid research—their formulation, in all probability, must await the development of improved tyndallometers and of stable clarity standards transferable from one laboratory to another. Filtration rates are another matter—Dicalite technicians have well established mathematical relationships for their prediction.

Actually, filtration engineering is an empirical science. Only by actual filtration tests can the selection be made of the proper grade of filteraid and the optimum dosage to obtain maximum throughput consistent with the desired clarity. Experience is an important factor in these tests, since familiarity with thousands of varied filtration systems helps tremendously in charting the most direct course through the many ramifications and possible procedures. Such experience is possessed in high degree by Dicalite service engineers and laboratory staff, among whom are nationally-recognized authorities on filtration. This is probably the reason why, each month, we perform scores of such series of tests for processors and filter manufacturers, either in their own plants or in the Dicalite laboratory. These tests, made without charge, are an important part of Dicalite service, aiding filteraid users to a solution of their problems and, at the same time, contributing to the steady advance in filtration technology.

Paul W. Leppla, *Technical Director*



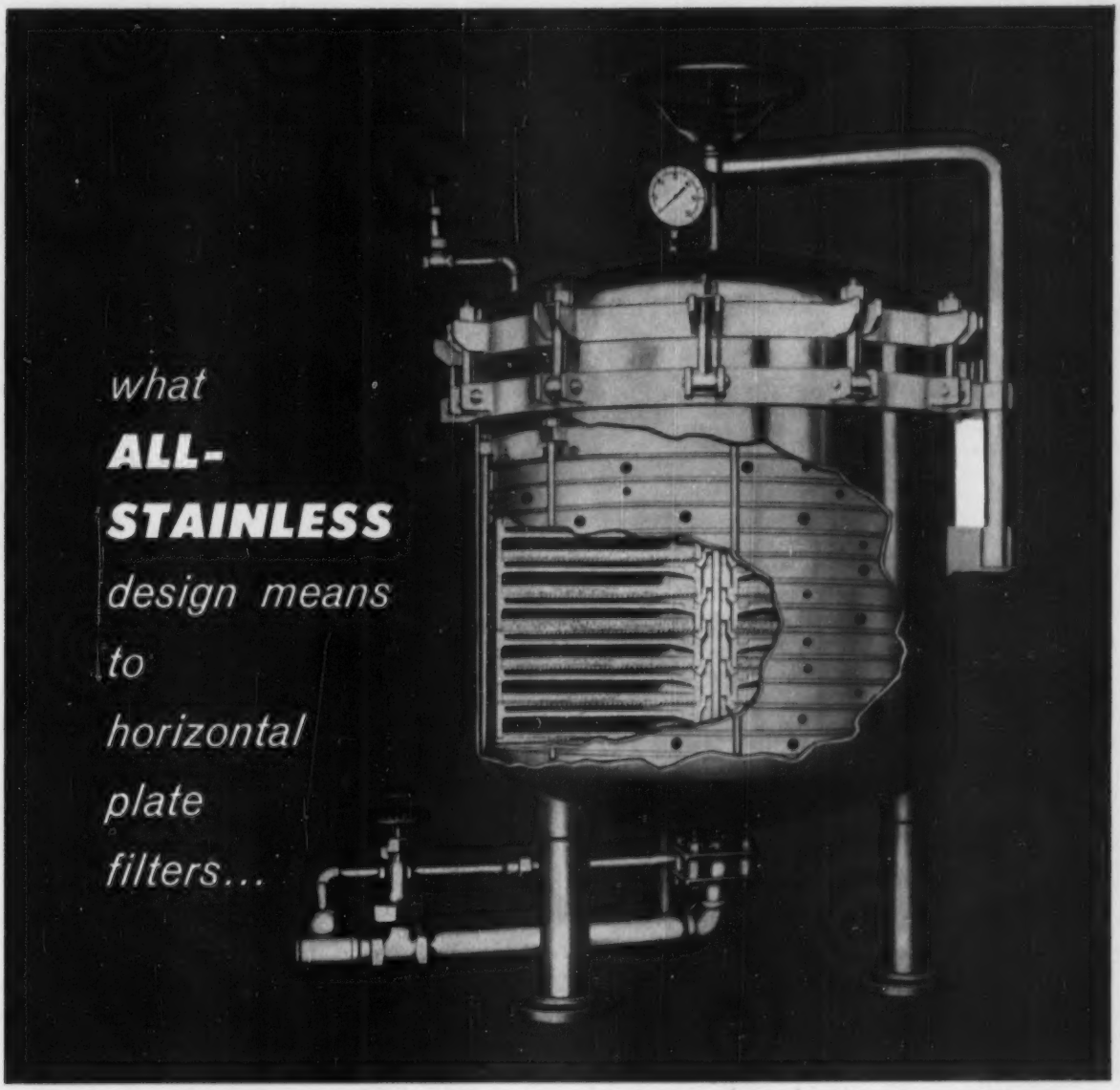
This problem was a little different from those usually met with by Dicalite's technical service men. A large oil company, working on a new oil additive, had asked if our service engineers could aid in improving an unsatisfactory filtration. So far, an everyday situation. But when the two technical men arrived at the refinery, they found that the importance of the new product had drawn observers from all parts of the company and even from other firms, all deeply interested in the results. It was almost like working in a spotlight.

However, our service engineers produced the answer. They made Dicalite bomb filter tests on the spot, balanced the factors of clarity, throughput and costs. They were then able to recommend a Dicalite filteraid which, in the oil company's own words, "gives us higher clarity and better economics."

While not routine, this is typical of the work of Dicalite's technical service men. They will either work with you in your plant or enlist the services of the Dicalite laboratory to help solve the problem. One way or another, Dicalite answers, each month, scores of such problems—and will be delighted to help you with yours. Just write us.

Dependable GLC GREAT LAKES Dicalite® DIATOMACEOUS MATERIALS

DICALITE DIVISION, GREAT LAKES CARBON CORPORATION
612 SOUTH FLOWER STREET, LOS ANGELES 17, CALIFORNIA



Crucible stainless steel, type 304, is used throughout this Sparkler standard horizontal plate filter.

Constant filtration of chemicals, pharmaceuticals, foods and liquids subject this horizontal plate filter to pretty rugged corrosive, abrasive and temperature conditions. That's why Sparkler Manufacturing Co. uses all-stainless steel construction.

For stainless, first of all, fights off corrosive attack. And it's strong. Stainless becomes tougher the more it's used . . . which is another way of saying that, with stainless, abrasion is no problem. And neither is cleaning. For stainless steels' smooth, bright surface comes clean with a minimum of effort . . . stays clean longer.

The fact is, stainless makes any equipment stronger, longer-lasting, easier to use. Check with your local Crucible representative for help in selecting the best stainless grade for your job. Or write *Crucible Steel Company of America, The Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

It's in the Bag!

Fresh, Clean Ink for a Year of Trouble-free Recording

★ You won't have any messy, time-consuming re-inking of pens on the new Bailey Recorders. The entire system is white-glove clean—hermetically sealed, non-evaporating, non-corrosive. Gone is any chance of sludge or oxide formation. Gone are clogged pens, interrupted records, unsightly splashes.

The transparent plastic ink sacs are changed once a year—that's all. Capillary tubing carries fresh, clean ink to the pens continuously without any day-to-day attention.

This exclusive new inking system* is only one of the many time-saving, money-saving distinctive features of the new Bailey Recorder.

Ask for Product Specification E12-5. P34-1

*Now available for the New Bailey Recorder only.

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers —or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY METER COMPANY

1054 IVANHOE ROAD

CLEVELAND 10, OHIO

Controls for Power and Process

BAILEY METERS

Controls for

TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW · LEVEL
RATIO · DENSITY

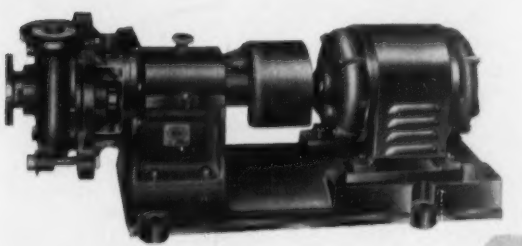
Highly potent insecticides begin with

WILFLEY ACID PUMPS

WILFLEY ACID PUMPS handle many of the basic ingredients used in the manufacture of insecticides. Whenever you see the name Wilfley on a centrifugal pump, you know that here is the ultimate in dependability, efficiency and economy. These famous pumps are known the world over for delivering continuous, trouble-free performance on even the most difficult pumping jobs.

WILFLEY ACID PUMPS are available with pumping parts of the machinable alloys as well as plastic to meet all requirements. Write or wire for complete details.

Individual Engineering on Every Application



A. R. WILFLEY and SONS, INC.
DENVER, COLORADO, U.S.A.
NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Acid Pump
Wilfley Sand Pump

MAKING "Rain Drops" the BUTAY WAY...

Outside Redler elevates material from track hopper to discharge either at storage tank or to 30 ft. inclined conveyor which in turn delivers to a horizontal conveyor on the plant roof.

This 5-inch Redler conveyor on roof receives material from the 30 ft. inclined Redler and in turn carries it 51 ft. to the point of discharge into plant (right foreground).

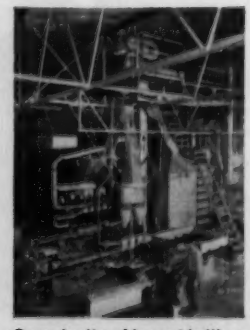
WITH AN S-A ENGINEERED BULK MATERIAL HANDLING SYSTEM!

Manufactured by the Butay Products Company, Los Angeles, "RAIN DROPS" is a water softening and blueing agent. To provide swift, economical conveying and mixing of this product's base ingredient, Stephens-Adamson engineered a system which saves many costly material handling hours.

Completely automated, this system consists of a batch skip, mixer unit, and L-type sealed casing Redler conveyors which eliminate all dusting problems. From the point of delivery outside the plant to the packaged product itself, raw material moves swiftly and smoothly by 100% mechanical means.

The Butay installation is an outstanding example of Stephens-Adamson overall planning. More than 50 years' experience in designing and manufacturing equipment that conveys at lowest cost per ton qualifies S-A for any assignment in mass movement of bulk material.

Close-up view of Redler elevator showing double leg at head end, assuring perfect discharge. Discharge is to storage or to roof conveyor. Rate 10 tons per hour. Sealed casing of Redler permits outside operation without housing.



Complexity of layout is illustrated by this interior processing station photo. Skip delivers to mixer which dumps to hopper feeding L type Redler. Mix is then delivered to packaging machine or to storage.

There is an S-A sales engineer in your area. Contact him for sound advice in your conveying problems.

STEPHENS-ADAMSON MFG. CO.
3 Ridgeway Ave., Aurora, Ill.
Los Angeles, Calif.—Belleville, Ontario

ENGINEERING DIVISION	STANDARD PRODUCTS DIVISION	SEALMASTER DIVISION
Designers and manufacturers of all types of bulk materials conveying systems.	A complete line of conveyor accessories—centrifugal loaders—car pullers—bin level controls, etc.	A full line of industrial ball bearing units available in both standard and special housings.

THE Broadest GUARANTEE
IN THE INDUSTRY
and the most Comprehensive
OTM Corporation, leading the industry since 1919, now provides an all-encompassing guarantee with BLUE RIBBON FLANGES. This exclusive OTM guarantee not only covers replacement of defective flanges—but guarantees against any and all damage resulting from a defective flange.
If it's not absolutely flawless it's not a BLUE RIBBON flange!
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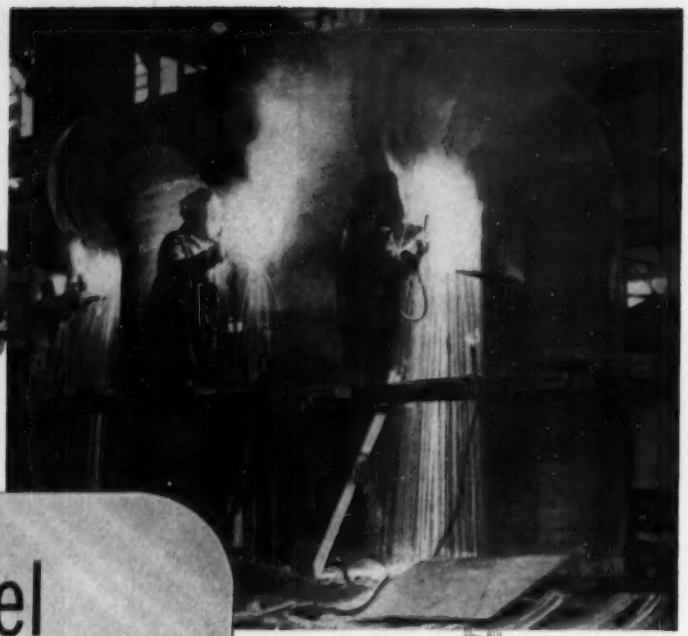


stainless steel holds the answers

Every industry that works with steel has its special problems of the proper steels for every job . . . more and more industries are finding that Stainless "holds the answers" to their problems.

Take the petroleum and chemical industries for instance. They demand resistance to corrosion, to abrasion, high temperatures, cold temperatures, scaling and hydrogen blistering. Solid stainless can do the job. But, in some equipment, stainless cladding can answer the problems . . . and cut costs as well.

Sun Ship knows how to fabricate stainless and the other special alloys. They have the facilities and experience. Large jobs or small jobs will receive prompt attention.

Our Sales Engineering Department will be glad to discuss with you any problems to which our Alloy Products Shop may hold the efficient and economical answer.

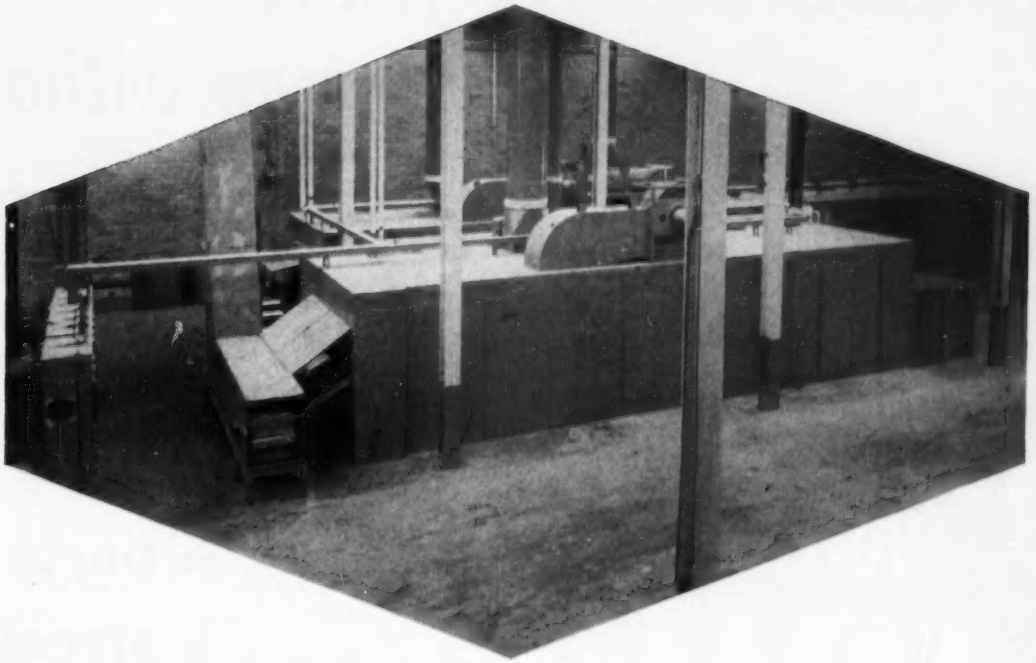
ALLOY PRODUCTS SHOP

OF Sun SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE • CHESTER, PA. • 25 BROADWAY, NEW YORK CITY

A Proctor

DRYING RANGE means HIGHEST PRODUCT UNIFORMITY!



Efficient drying per pound of product can often *mean more direct profit to you* than an increased sales volume! Proctor equipment provides the control, flexibility, and construction features *essential* to profitable drying performance. The result—increased yield of highest quality product. Write or phone *today* for complete information.

Product Uniformity is of utmost importance to every food processor, at all stages of processing.

Shown above is one of many Proctor & Schwartz dryer installations in one of the country's larger food plants—typical of the many in use in the food industry today. Here, because of Proctor drying skills, uniformity of color, taste, and overall customer appeal is maintained at uniformly highest levels—yields are greatly increased!

★ PROFITABLE OPERATION
★ INCREASED YIELD
★ GUARANTEED PRODUCT QUALITY
★ "W/M" CONSTRUCTION
★ FLEXIBILITY OF OPERATION

PROCTOR DRYING EQUIPMENT FOR THE FOOD AND PROCESS INDUSTRIES

• Tray Dryers • Truck Dryers • Pre-Forming Feeds
• Continuous Conveyor Dryers • Spray Dryers

Proctor

PROCTOR & SCHWARTZ, Inc.

Manufacturers of Industrial Drying Equipment and Textile Machinery
Philadelphia 20, Pa.

If you're not in the book *you're a man without*

. . . . . a country
. . . . . a state
. . . . . a county
. . . . . a town
. . . . . a party
. . . . . a street
. . . . . a school
. . . . . a *vote*

Look at all the things you can lose, if you're not a registered voter.

If you're not in the book, you lock yourself out of the elections. The polls are closed to you. You can't vote on streets, or schools, councilman or mayor (not to mention congressman, senator or president). You don't even have the right to *complain* about your government and the way things are run!

But more than that, you cut yourself apart from your neighbor next door, your friends at the shop, your fellow members in union or club.

You lose the right to look that boy of yours in the eye when he wants to know if you're doing your part.

And you lose the self-respect that comes from knowing you can walk into the polls on Election Day—the one place in the world where all free men are really equal. Isn't it too much to risk for the little time that registering takes?

Get your name in the book
—and do it now!

Is your name in the book?

NEWS ITEM . . .

Gulf Coast refinery engulfed by capacity demands of kerosene cooler

Solved by

RETUBING with WOLVERINE TRUFIN* TYPE S/T

From a first class bottleneck to a unit producing 80% more than original capacity is the story of a kerosene cooler in the process line of a Gulf Coast refinery.

The cooler, a plain tube unit, was unable to keep up with the refinery's constantly increasing production demands. There were two ways in which refinery engineers could handle the situation:

(1) A new and larger unit could be designed and built.

(2) The existing unit could be retubed with Wolverine Trufin Type S/T—the integral finned condenser tube.

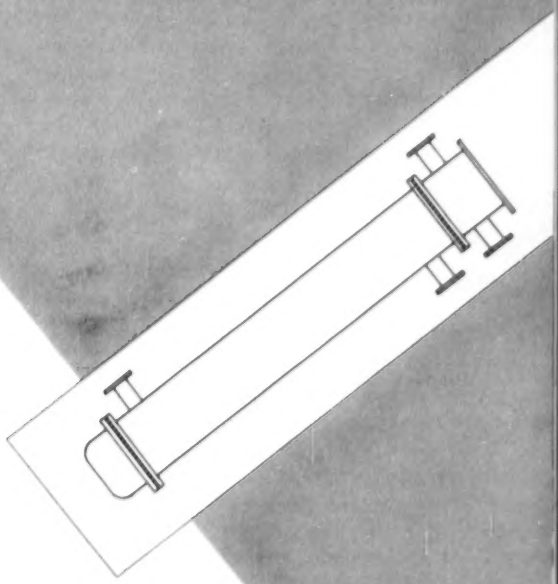
After careful consideration it was decided to retube with Wolverine Trufin. The results were immediate and highly satisfactory. Production on the cooler could be increased by a full 80%—and the bottleneck was a thing of the past. In addition the refinery realized substantial savings in time plus the elimination of the costs of designing and building a new unit.

The reason for Trufin's ability to boost heat transfer performance is found in its integral fins—extruded directly from the tube wall. Because of this, Trufin S/T has approximately twice the heat transfer surface of plain tube—extracts more BTU's per foot of tube.

Trufin Type S/T is completely interchangeable with prime surface tube using standard tools and retubing techniques.

If your plant has similar bottlenecks, Wolverine Trufin Type S/T condenser tube can help you solve them. Next time you retube, specify Trufin—watch production go up and costs stay down. Wolverine's new Process Flowsheet Catalog is filled with process drawings of actual Trufin installations. Write for your copy today.

WOLVERINE TUBE, 1443 Central Avenue, Detroit 9, Michigan.



Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario.

DIVISIONS OF CALUMET & HECLA, INC.

CALUMET DIVISION
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO., LTD.
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GOODMAN LUMBER CO.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

*REG. U. S. PAT. OFF.

587WS2—5265

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK.

WOLVERINE FIELD ENGINEERS answer questions about TRUFIN* TYPE S/T condenser tube

Frequently, Wolverine Field engineers are asked this question:

In what type of application is Wolverine Trufin* Type S/T most advantageous and to what extent?

Their answer: **Trufin offers most advantages when used for change of phase services such as condensation and vaporization.**

CONDENSATION: The rate of condensation is closely related to the thickness of the condensate film which collects on the tubes; the thicker the film—the lower the rate. The action of Trufin, cutting through the condensate film, restricts the thickness to which the film can build up. The result is an appreciable gain over the condensing rate obtainable with the same number of square feet of prime surface tube.

VAPORIZATION: For such units as reboilers and evaporators, Trufin offers tremendous advantages although the reason and mechanism naturally differ from fluid-to-fluid heat transfer. The convection is much more vigorous and the vaporization transfer rate is higher because a square foot of Trufin surface occupies much less volume than a square foot of plain tube surface.

Furthermore, the upper edges of the fins preferentially serve for bubble nucleation; thus, the bulk of the surface is less susceptible to vapor binding than plain tube surface and heat flux limitations are not decreased by the reduced volume of the exchanger.

The advantages of Wolverine Trufin Type S/T over plain surface tube can vary from a small percentage to gains of 100% on a lineal foot basis depending on the type of application. For ideal conditions such as those that exist in some hydrocarbon condensers and reboilers, the increase in effectiveness can actually be greater than the outside area ratio of Trufin over plain tube.

Similar information along with valuable design data is contained in Wolverine's Trufin Opportunity Book. Write for your copy today.

WOLVERINE TUBE, 1443 Central Avenue, Detroit 9, Michigan.

*REG. U. S. PAT. OFF.

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Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK.

Magnetic ideas from ERIEZ

NO TIPPING ALLOWED! Here's one tip the waiter doesn't have to worry about . . . because the tray perched precariously over the edge of the table is held securely in place by a hidden Eriez Permanent Magnet. This idea of herculean strength and permanent dependability has found a practical use in industry, where Eriez HI-POWR Magnetic Separators are used in processing lines to remove dangerous tramp iron before it can cause fires, product contamination, machinery damage and downtime. Eriez HI-POWR Magnets are also used to control, convey and hold metals, from small parts to large pipes. In addition, Eriez produces HI-VI electro-permanent-magnetic vibratory feeders and bin vibrators. *All Eriez HI-POWR Magnets are non-electric, self-contained. They operate without wires or attachments. Magnetic power is guaranteed forever; the first cost is the only cost.*

ERIEZ PLATE MAGNETS HAVE POWERFUL PULL! Magnetic attraction pulls tramp iron from *moving flows up to 4" deep* . . . and holds caught metal securely! Economical Eriez Plate Magnets are quickly and easily installed . . . provide maximum efficiency with minimum cost. They work equally well with wet or dry materials, withstand temperatures to 850°F. Available in fully enclosed stationary or hinged models, for installation on wood or steel, in or above flowing lines. All sizes. Strong, riveted construction. Many powerful strengths; depth and rate of flow determine magnetic strength to be used. Magnetic power is guaranteed *forever!*

PULLEY PROTECTS PRODUCT PURITY! At the Libby food processing plant in Blue Island, Illinois, product purity is of prime importance. To prevent ferrous contamination of the processed food, an Eriez HI-POWR magnetic pulley was installed as the head pulley on a belt conveyor line that feeds tomatoes to the cooker. As the belt carries the tomatoes over the pulley, they fall into the cooker, while the tramp iron is held fast to the belt until it is automatically dropped out of the magnetic field. In addition to assuring a contamination-free product, the magnet has prevented machinery damage, and saves about 200 hours of down-time each season.

New! Eriez HI-VI VIBRATORY EQUIPMENT

First complete line of electro-permanent magnetic vibratory equipment operating at 3600 CPM directly off an AC line. No rectifier needed! . . . just plug in. Greater vibratory output with less power consumption. Less maintenance; lower installation costs. Permanently powered guaranteed Alnico V magnetic element (heart of the unit) produces an exclusive "double action" drive for more productivity.

Write for complete information on HI-VI Unit (bin) Vibrators to keep bulk materials flowing freely. HI-VI Vibratory Feeders for accurate, controlled feed.

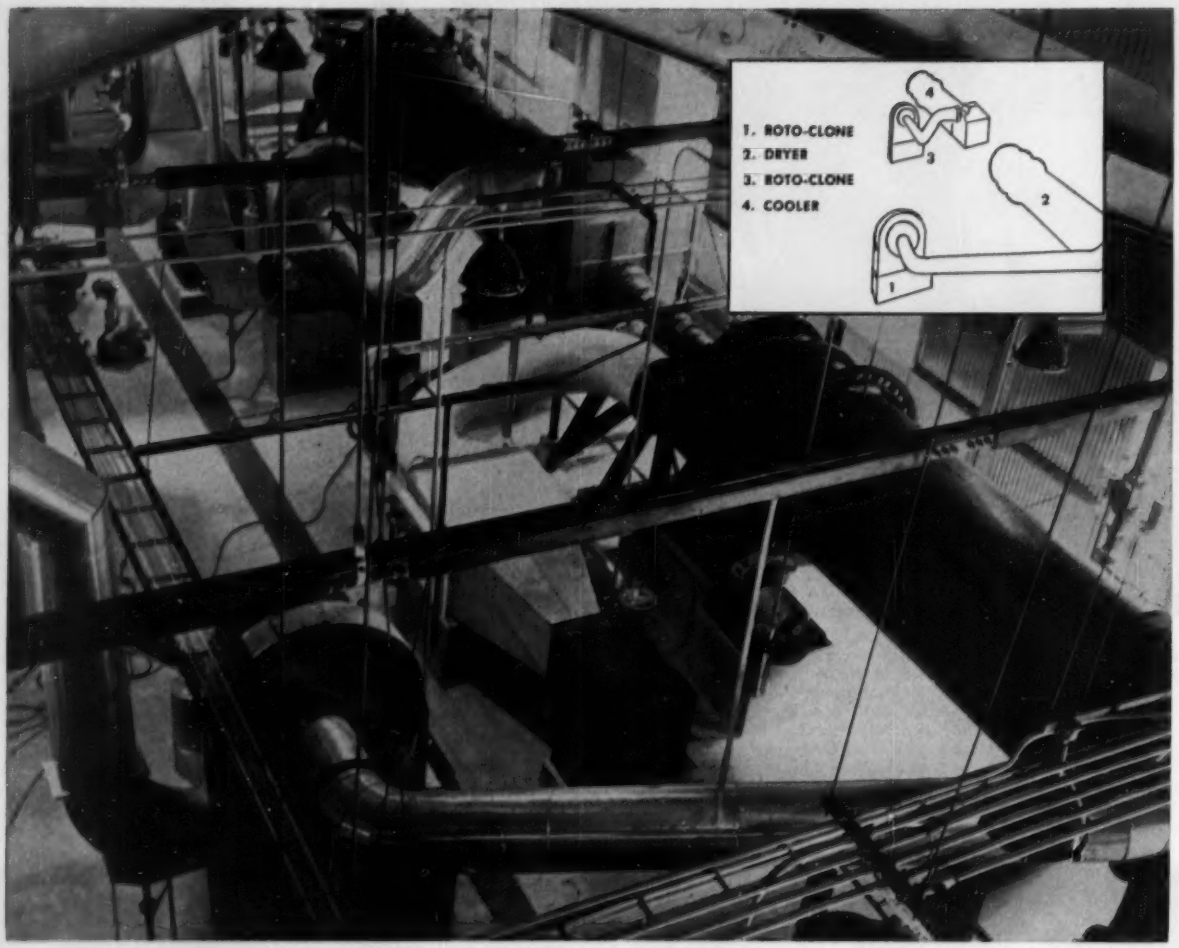
Patent Pending

DRAWER-GRATE MAGNET DRAWS GREAT PRAISE! To safeguard expensive precision equipment from tramp iron damage, the Toms River-Cincinnati Chemical Corp., manufacturer of vat dyes, installed a series of Eriez Magnets in their processing lines. One of these units is a stainless steel drawer type grate magnet, placed in the feed duct and hood of a micro-atomizer. Designed to remove stray metal from free-flowing lines, this unit has proved, according to company officials, "100% effective." It is daily trapping amounts of unwanted iron which could damage equipment and cause downtime. In addition to the enclosed grate magnet shown here, Eriez also makes a wing-type model for quick installation in open hoppers, bins, chutes, etc.

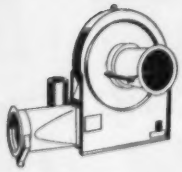
ERIEZ HI-POWR MAGNETIC SEPARATORS

ERIEZ HI-VI VIBRATORY EQUIPMENT

● ***Eriez' free booklet "Magnetic Ideas" can help you. Send for it without obligation, ERIEZ MANUFACTURING COMPANY, 746 Magnet Drive, Erie, Pa. OR on your specific request Eriez factory-trained field men backed by Eriez' laboratory and engineering know-how, will be happy to study your particular problem, make a plant survey and offer helpful "Magnetic Ideas".***



ROTO-CLONES Help Brea Chemical Make Fertilizer WITHOUT DUST



AAF Type W wet collectors salvage valuable material, too!

The AAF Type W ROTO-CLONES pictured above are doing two important jobs for Brea Chemicals, Inc., Brea, California—eliminating neighborhood dust nuisance and recovering valuable material.

1 The dryer and cooler discharge stacks are virtually dust-free because the ROTO-CLONES remove the fine ammonium nitrate particles picked up by the exhaust gases.

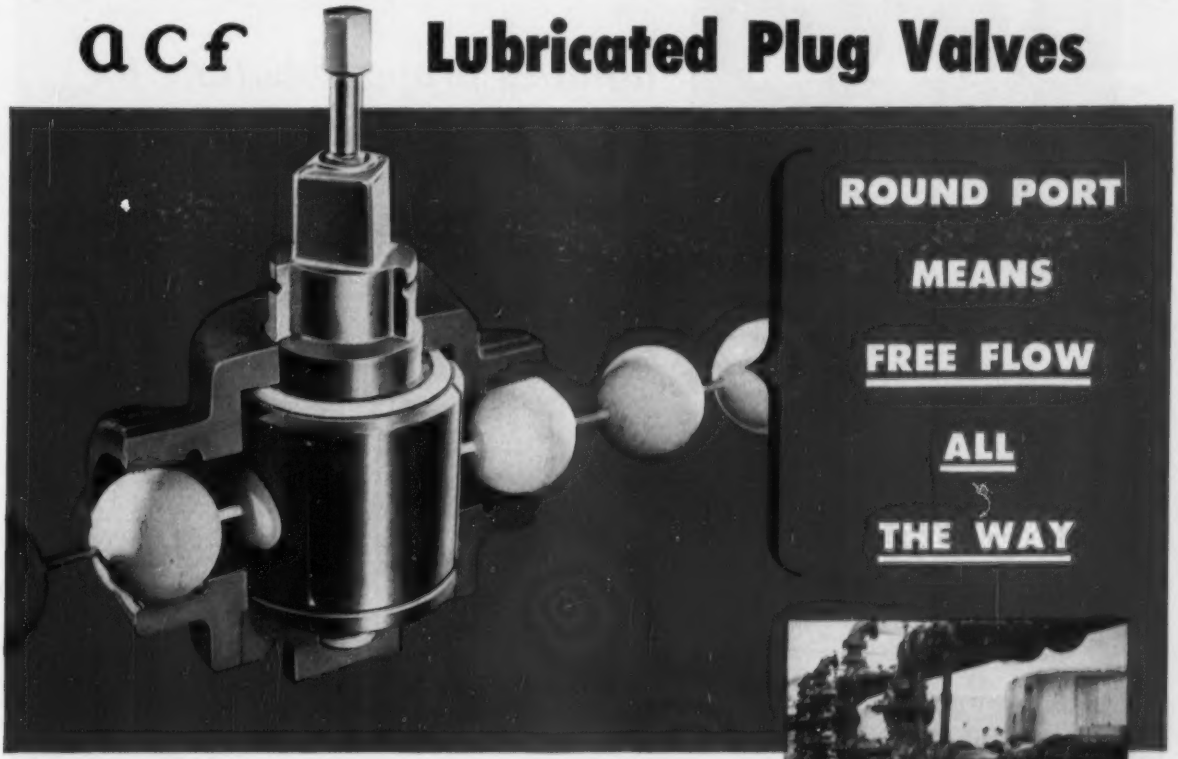
2 By using liquid ammonium nitrate in place of water in ROTO-CLONE scrubbing sprays, all collected dust is returned to the process as a usable slurry.

That's typical of the work done by Type W ROTO-CLONES in scores of similar operations. The Type W's efficiency results from its unique design, which combines the scrubbing action of liquid sprays with the principle of dynamic precipitation. For complete information, call your local AAF representative or write direct for Bulletin 274.

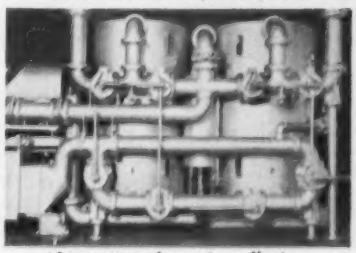
American Air Filter
COMPANY, INC.
326 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

BETTER AIR IS OUR BUSINESS

acf Lubricated Plug Valves



In salt water disposal plant.


Absorptive dryer installation.

In natural gasoline plant.

You get full volume, unrestricted flow throughout the entire piping system when you use acf Round Port Valves.

The pipe-matching port openings cause no loss in head pressure—offer no more resistance to flow than the pipe itself. There are no obstructions—no turbulence and no harmful abrasive effects from solids in suspension. Even the most heavy viscous ladings flow freely through acf Round Port Valves.

Split-second quarter-turn shutoff, non-wedging cylindrical plug, Teflon* head gasket, are additional advantages that add to perfect performance of acf Round Port Valves—that mean extra long trouble-free service—lower maintenance costs and fewer work stoppages.

Act now to step up valve performance—to keep maintenance costs down. Representatives in 50 principal cities.

*DUPONT TRADE NAME

W-K-M MANUFACTURING COMPANY, INC.
A SUBSIDIARY OF acf INDUSTRIES INCORPORATED
PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

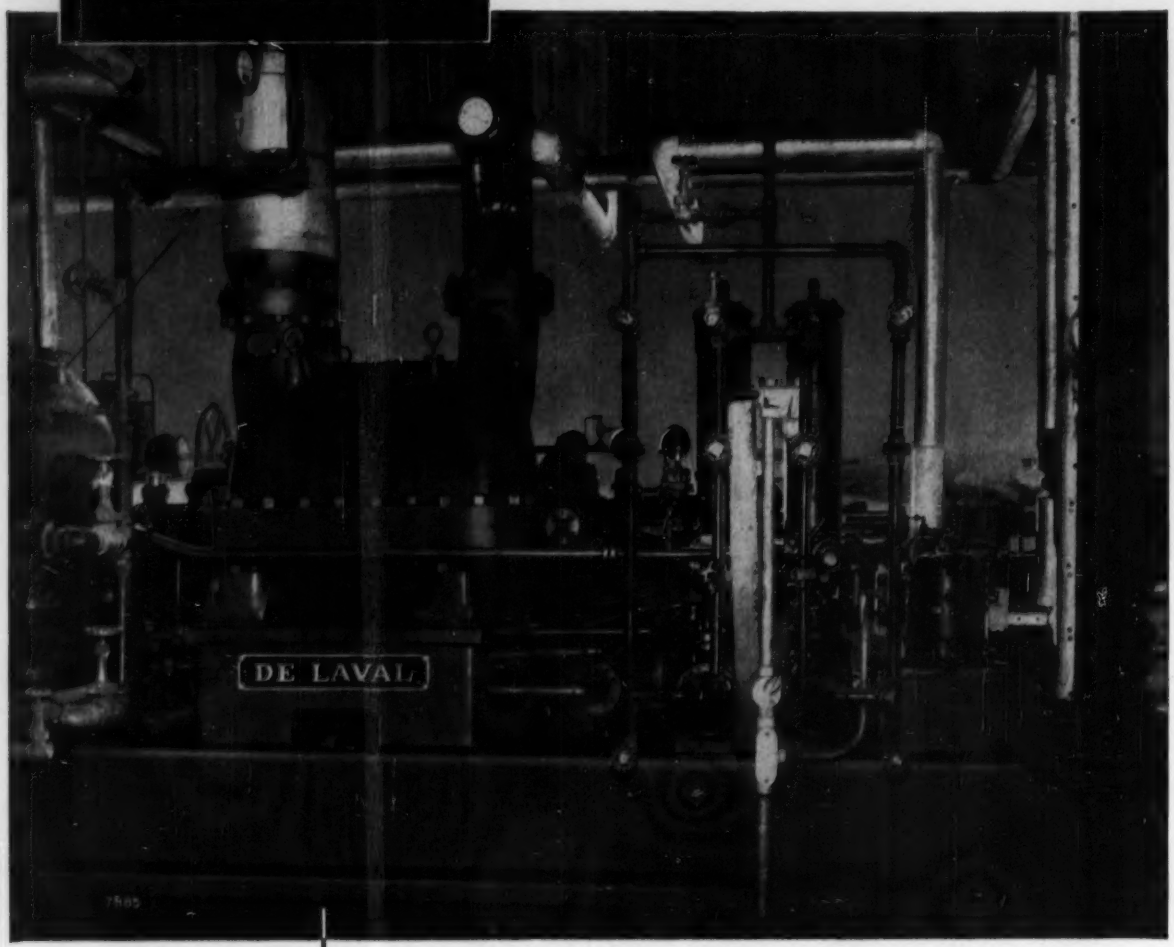
W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS

DE LAVAL CENTRIFUGAL COMPRESSOR

handles propane-butane for M. W. Kellogg alkylation unit



New Bulletin 0504 gives complete data

On stream at a plant of a large mid-western refiner, this De Laval unit compresses the propane-butane mixture to prepare it for an M. W. Kellogg alkylation unit.

Inlet volume of the De Laval centrifugal compressor is 3,040 cubic feet per minute. Inlet pressure is 18 psia, and discharge pressure 85 psia. This compressor is equipped with De Laval contact-type oil seals. The unit is driven by a 600 bhp turbine running at 7,400 rpm.

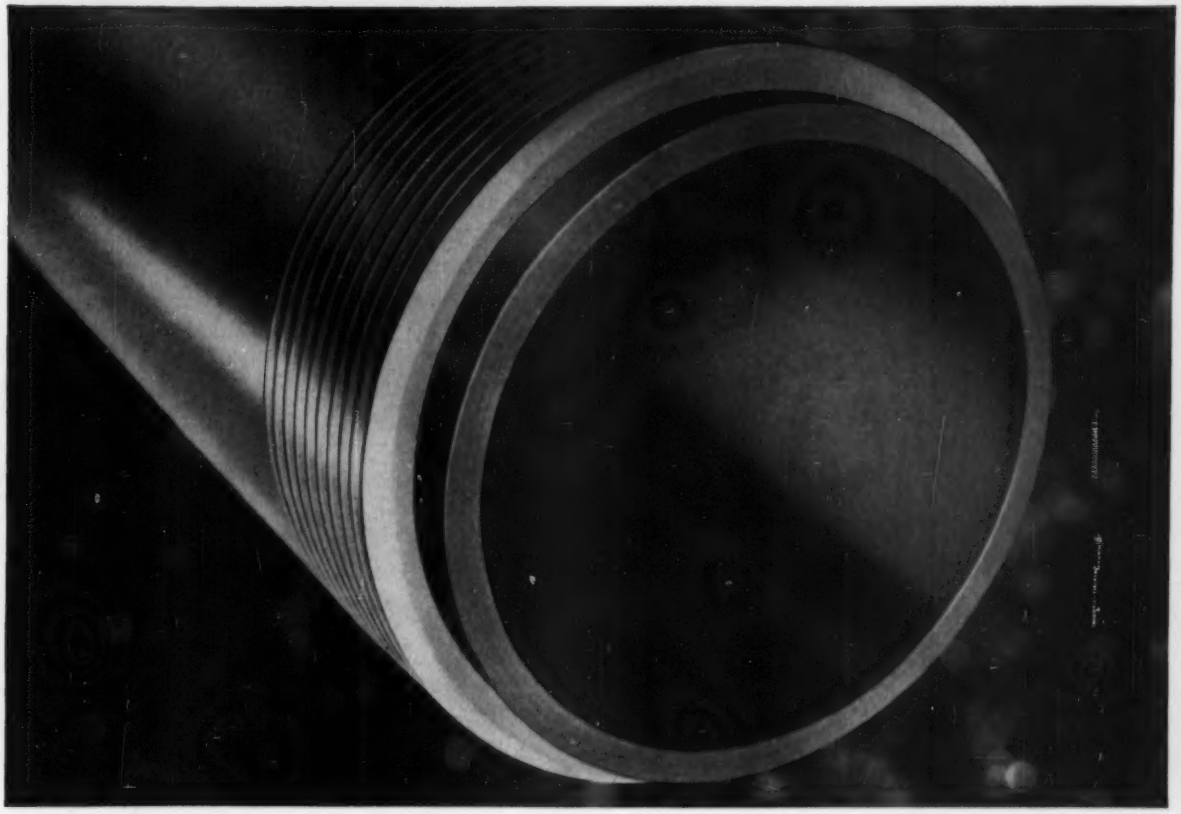
De Laval compressors are designed and built for heavy duty continuous operation. Rugged, horizontally split casings, individually designed impellers, perfectly balanced rotors and externally mounted, cylindrically seated bearings assure optimum performance and long service.

DE LAVAL *Centrifugal Compressors*

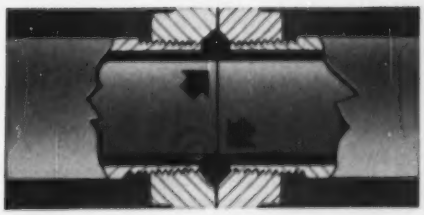
DE LAVAL STEAM TURBINE COMPANY
803 Nottingham Way, Trenton 2, New Jersey

DL 508

DOW



You can see why Saran Lined Pipe prevents corrosion



Liquid never touches metal in Saran Lined Pipe even at a flanged connection like this.

Acids, alkalis and other corrosive liquids never touch the rigid steel pipe . . . it's continuously lined with durable, corrosion-resistant saran

Say good-by to corrosion problems when you install saran lined pipe, fittings, and valves. This combination of corrosion-resistant saran swaged into rigid, non-bursting steel has a proved record of corrosion prevention in the chemical, petroleum, waste, pulp and paper, metal finishing and food processing field.

Saran lined pipe, fittings and valves form tight, snug, leakproof joints . . . is available for working pressures up to 150 psi. Fittings and valves are also available in steel for working pressures to 300 psi. You'll be amazed how easy and economical it is to install this modern piping, too. For it can be cut and threaded in the field with available pipe fitters' tools. And because it's rigid, a minimum of supporting structures are needed.

For further information on saran lined pipe, fittings, and valves send in the coupon on the right today. THE DOW CHEMICAL COMPANY, Midland, Michigan.

Saran Lined Pipe Company
2415 Burdette Avenue
Ferndale, Michigan
Dept. SP-627A-1

Please send me information on saran lined pipe, valves, and fittings.

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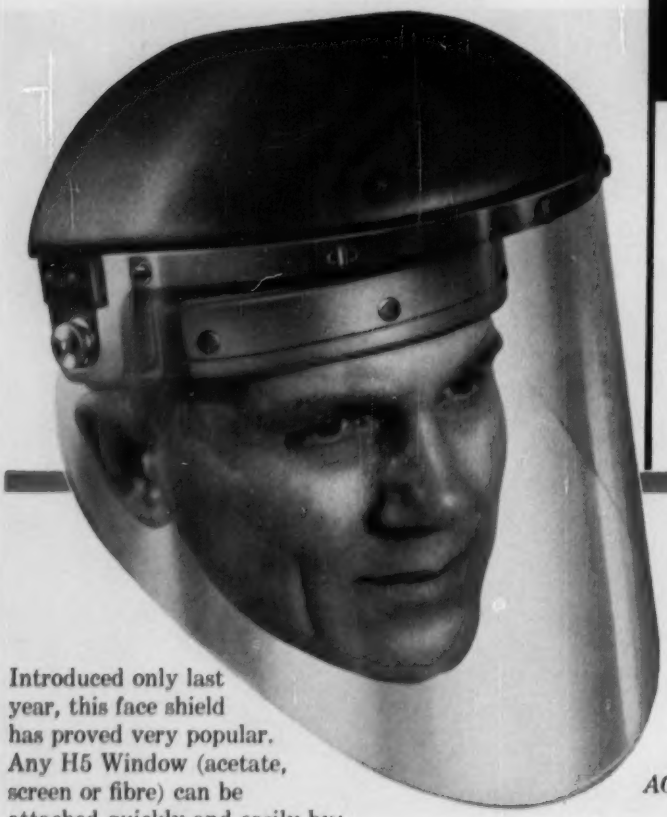
Saran Lined Pipe is Manufactured by The Dow Chemical Company, Midland, Michigan

you can depend on DOW PLASTICS DOW

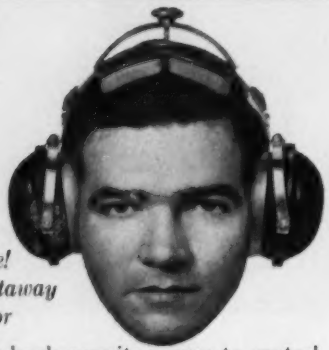
AO Specialty Safety Products

Windows Interchange Quickly on the Splash Proof

AO H5 FACE SHIELD

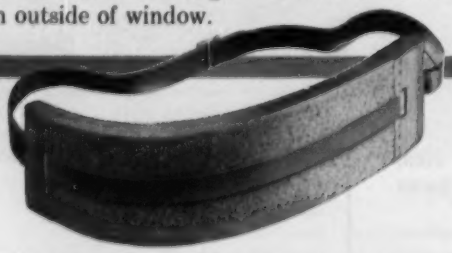


Introduced only last year, this face shield has proved very popular. Any H5 Window (acetate, screen or fibre) can be attached quickly and easily by: 1. Sliding back two end clips; 2. Placing slotted window over five studs; 3. Turning top of three centre studs to vertical position; 4. Sliding the end clips forward over back edge of window. Chemical splashes cannot enter between window and headgear but roll off the Crown down outside of window.



It's Adjustable!
AO 372-14 Straightaway Sound Protector

Manual adjustment knob permits wearer to control pressure as harmful industrial noise increases or decreases — a comfort feature. Protector covers jawbone opening. Excellent for low and high frequency noise levels. Durable Neoprene rubber covered metal spring type headband. Dielectric vinyl sponge earcups provide complete ear seal. Easily sterilized. Many other features. Write for literature.



Reduce Eye Dispensary Cases and Keep Workers Cooler . . . More Comfortable . . . with AO SWEATBANDS

No one can do his best work if he has to keep wiping sweat out of his eyes continually. And blurred vision can lead to a costly accident!

There's a simple, inexpensive remedy — AO Cellulose Sponge Sweatbands. Our 108B Sweatband for example, is 1" wide — ideal for use with hard hats and welders' helmets.

QUICK FACTS

- **Absorbs 16-20 times its own weight in perspiration**
- **Dip in water, squeeze out before use for greatest efficiency**
- **Washable — can be sterilized**
- **Lower in cost than leather sweatbands**

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Why spend time cutting and fitting small pieces of rigid insulation . . . when you can **WRAP YOUR TANKS WITH EFFICIENT ULTRALITE AND REAP THE SAVINGS?**

NO CRACKING under expansion and contraction, for **ULTRALITE** is flexible and *permanent*. No expansion joints . . . no pointing up.

A candid look at a new concept in tank insulation

These photos explain why **ULTRALITE**, the long glass fiber insulation in rolls, is rapidly becoming **THE** insulation for tanks and vessels of all kinds. For "How-to-do-it" specifications and immediate delivery, consult the Yellow Pages under "Gustin-Bacon Insulations" and call your local **ULTRALITE** distributor in any of 67 cities, or . . .

WRITE TODAY FOR TECHNICAL INFORMATION

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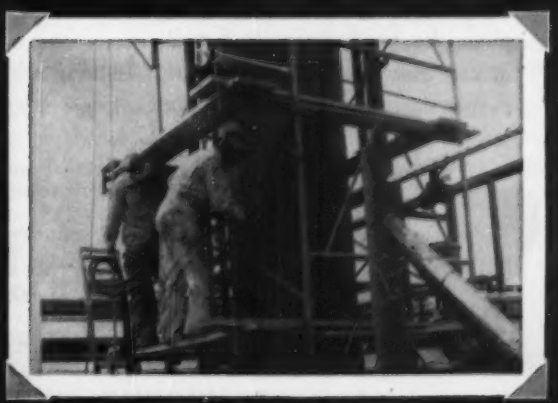
Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Molded glass fiber pipe insulation

Lightweight **ULTRALITE** comes in rolls up to **10 FT. WIDE**, in thicknesses up to 6 ft. and densities up to 3 lbs. per cubic foot. Thermal efficiency?—Average K factor is .27 at 70° mean temperature.

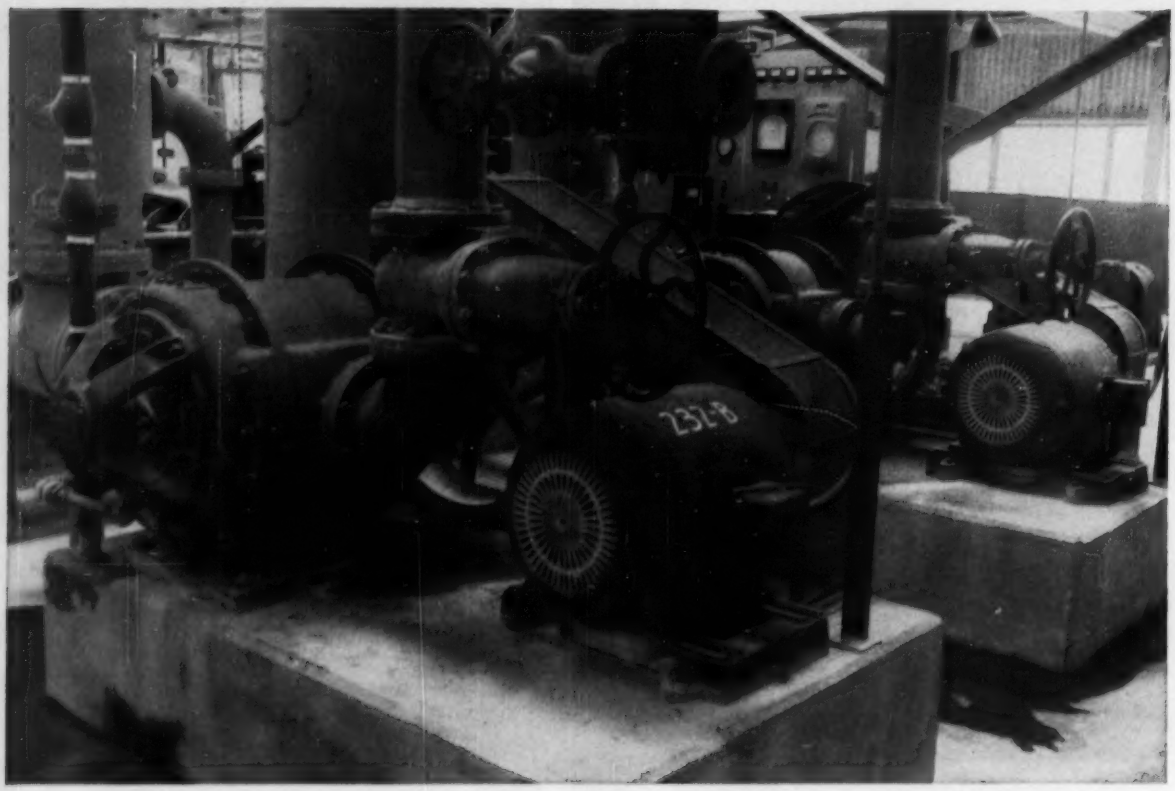
The bigger the tank, the bigger the saving—but don't overlook the economy of **ULTRALITE** on *all* tanks, vats and vessels!

Whether you run **ULTRALITE** up and down, or round and round, you only need **HALF** as many fasteners to hold **ULTRALITE** firmly in place.



ULTRALITE can be weatherproofed with any of the customary materials. On towers wrapped with **ULTRALITE**, weatherproofing materials are often sprayed on reinforcing membranes such as mesh screen and glass fabric.

WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY



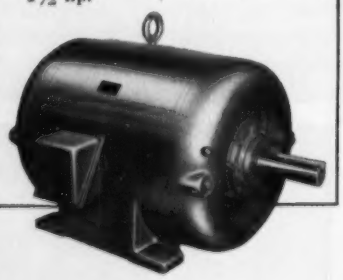
Designed for use in chemical plants
WAGNER EP MOTORS

Here are stock motors specifically designed for the chemical industry —they're fully protected against corrosive fumes and liquids, dust, dirt or moisture.

Such protection is assured by totally-enclosed fan-cooled construction in corrosion-resistant cast iron frames. Extra protection is given the laminations by a wall of cast iron that completely surrounds the stator. Even though the windings are completely enclosed, they are treated with a special coat of varnish that resists acids and alkalies. A running shaft seal, sealed leads and a gasketed conduit box give still further protection to these motors.

A skilled Wagner engineer, expert in motor applications, can help you select the Wagner Motor that meets your most exacting specifications. Call the nearest of our 32 branch offices, or write us.

Wagner Chemical Plant Motors are available in ratings from 1 to 250 hp in standard (Type EP) and explosion-proof (Type JP) designs, and in Non-ventilated corrosion-resistant standard and explosion-proof types in ratings from ½ through 1½ hp.



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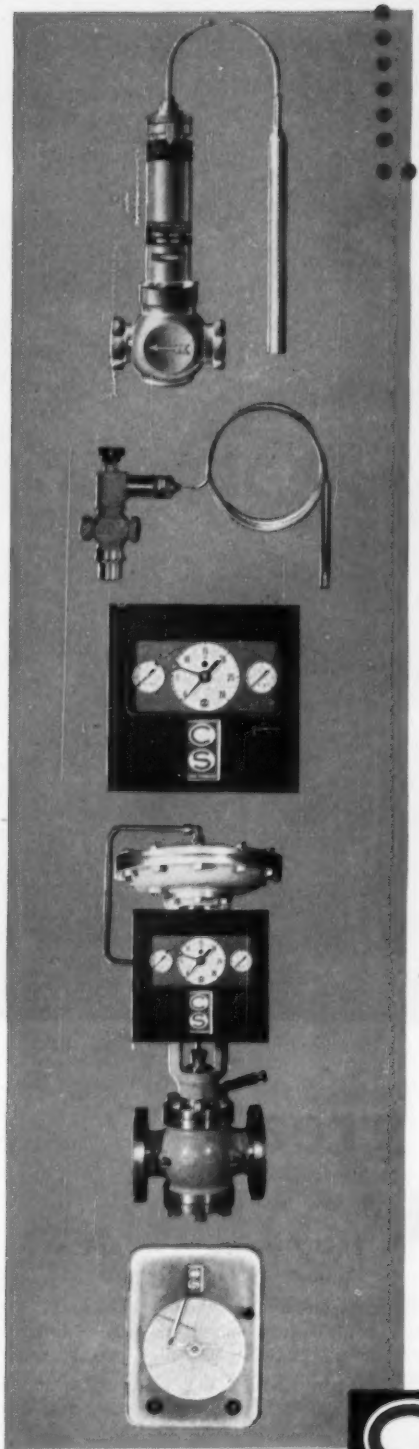


For Accurate, Reliable Temperature Control

STACON V SERIES
Self Operating Temperature Regulators—

Feature a liquid filled thermal system for high operating power and uniform throttling action and has built-in over-load protection. Available in 50°F. and 100°F. ranges from 25° to 325°F. Direct and reverse acting units ¼" to 1½" with screwed ends, and 2" to 4" with flanged ends. Bulletin No. 500. (Cash Standard Stacon Corp.)

STACON TYPE VS
Temperature Safety Regulators—

Used in the supply steam or gas line and will protect a process by snapping shut when the process temperature goes above a desired temperature level. Easily adjustable and remains closed until manually reset. Available in sizes from ½" to 1½" with screwed ends. (Cash Standard Stacon Corp.)

CASH STANDARD TYPE 51
Indicating Controllers—

An air operated, mercury actuated proportional temperature controller. Temperature ranges from —40°F. to 1000°F. Calibrated set point adjustment, unit construction, air relay with sapphire orifice and push button cleaner, feedback type proportional control with 1-100% band and differential gap. Also available with 1-150% proportional band combined with automatic reset action. Bulletin No. 978. (A. W. Cash Co.)

CASH STANDARD TYPE 30
Diaphragm Control Valve (With Type 51 Mounted)

A rugged, dependable control valve—available in sizes ½" to 12" with various styles of inner valves—reverse or direct acting. Accurate control is assured when the Type 30 is used with 51 or 57 controllers, valve mounted as illustrated, or where the controller is installed remotely. Bulletin No. 980. (A. W. Cash Co.)

CASH STANDARD TYPE 57
Recording Controllers—

An air operated temperature controller with mercury, vapor, gas or organic liquid actuation. Temperature ranges from —350°F. to 1200°F. Available in 9" and 12" case size, spring or electric driven chart drive, on-off control or 1-100% proportional control.

All units have push button nozzle cleaner; proportional controllers also have sapphire jewelled relay orifice with push button cleaner. Bulletin No. 979. (A. W. Cash Co.)

WHAT'S *YOUR* TEMPERATURE CONTROL PROBLEM?

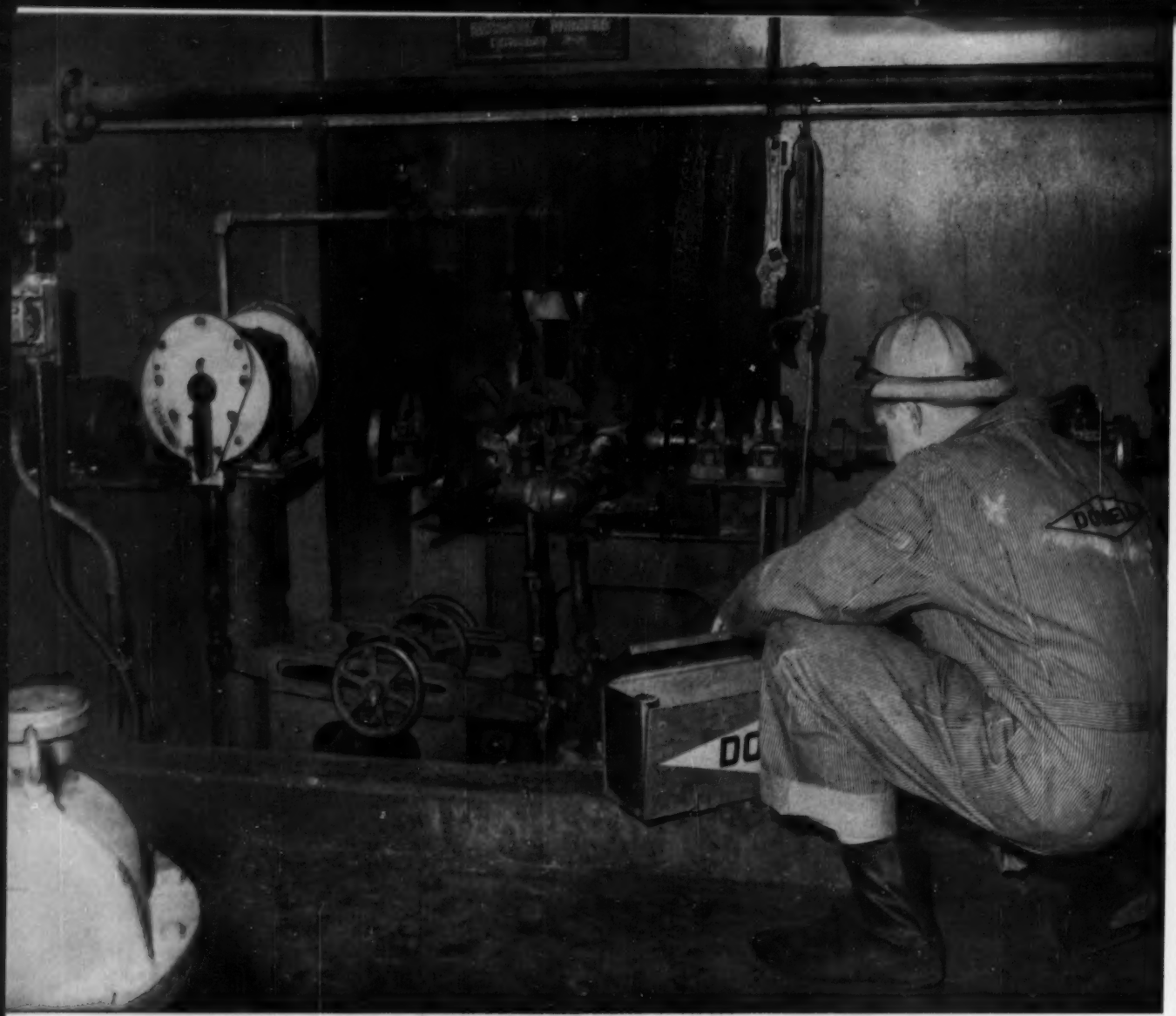
Cash Standard and Stacon have the answer or will find one.

Contact the Cash Standard temperature and pressure control specialist in your area, or write Dept. A.

CASH C S **STANDARD**

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS



The risk is too great —clean it right

You don't take risks when men, equipment, and lost production time are involved. That's why more and more companies are investigating the methods and firms used in their chemical cleaning. They know it's work for experts.

What are they concerned about?

First, they want to know they are getting the benefits of experience. These benefits include less downtime and more thorough cleaning. Dowell has this experience with over 15 years and 10,000 boilers alone to their credit. In saving downtime, Dowell often cleans equipment while it is in operation.

Next, these companies want to be sure their men and equipment have the greatest possible protection. Dowell excels here, too. For safety is foremost in the Dowell engineer's mind. Thoroughly trained, he uses only the latest safety methods and equipment. He works closely with your safety personnel to establish safest possible working procedures.

Be sure you are getting maximum results with maximum protection in your chemical cleaning.

Call the Dowell office near you. Dowell engineers are ready to discuss and help you with your cleaning problems any time, at no obligation. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. G-33.

chemical cleaning service for industry **DOWELL**

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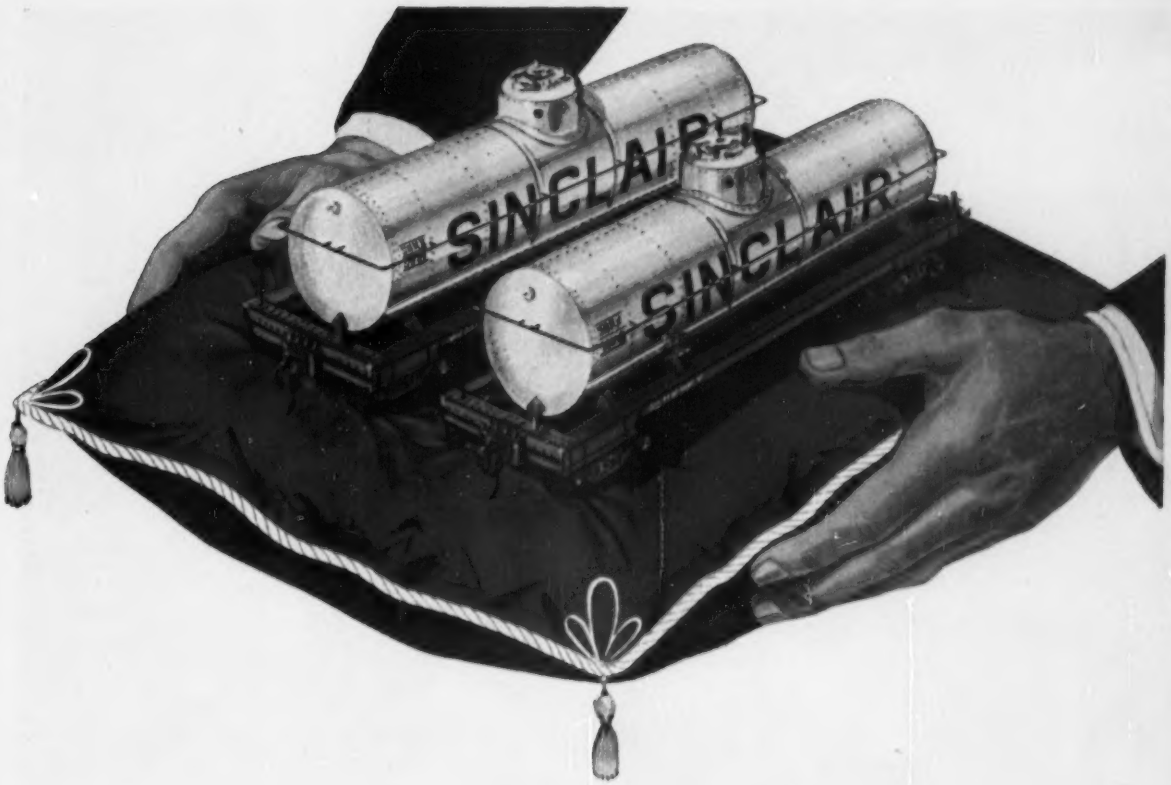

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Two special fleets of tank cars are added assurance that you get what you pay for when you specify Sinclair! To guard against contamination, Sinclair ships odorless solvents and aromatics in separate tank car fleets used exclusively for this purpose. It saves trouble!

TRULY ODORLESS SOLVENTS – Sinclair's team of truly Odorless Solvents, both Light (340-405° F.) and Heavy (375-465° F.), are synthetically produced from carefully selected hydrocarbons to insure the uniformity, stability and superior quality required by manufacturers of odorless paints. Available in full, or split tank car quantities.

HIGH PURITY AROMATICS – Toluol (1° nitration grade), Xylol (5°), and Paraxylene (98%) are being produced by modern Udex extraction facilities at Sinclair's Marcus Hook, Pa., refinery. Available in full, or split tank car quantities.

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Aluminum tank for rocket fuel

Do you make or use or store liquids that cannot be contained by carbon steel vessels? If so, Graver will build your tanks and process equipment of corrosion-resisting alloys —stainless, or stainless-clad or aluminum.

Graver's highly developed techniques in alloy welding make it possible to build storage and process vessels to exacting new specifications of corrosion resistance.

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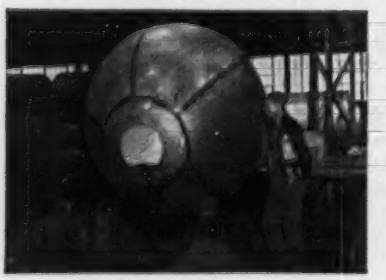
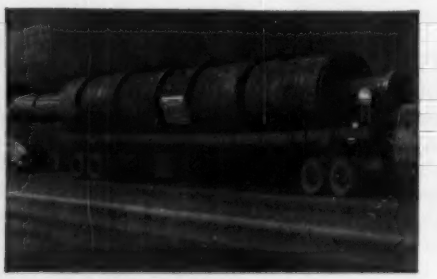


Solid stainless sphere for gas



Stainless-clad vacuum column

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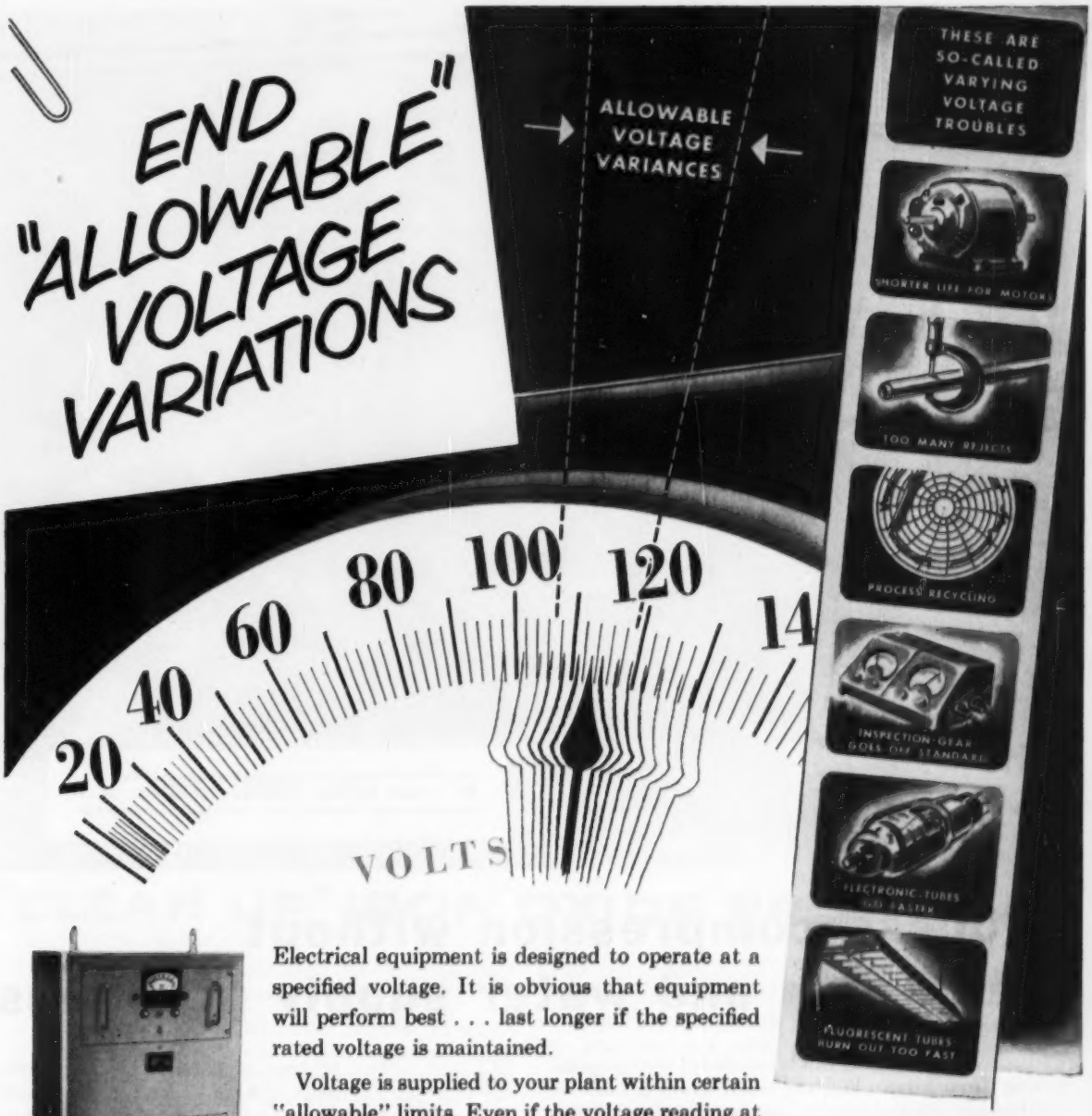

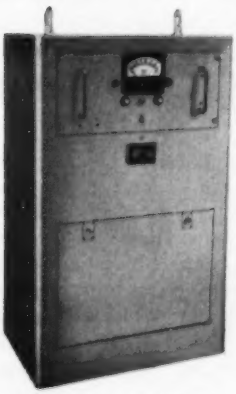

STABILINE type EM6220Y

Electrical equipment is designed to operate at a specified voltage. It is obvious that equipment will perform best . . . last longer if the specified rated voltage is maintained.

Voltage is supplied to your plant within certain "allowable" limits. Even if the voltage reading at your doorstep is right on the button, voltage variations occur within the plant.

STABILINE* Automatic Voltage Regulators end voltage variation headaches. They maintain constant specified voltage to voltage-sensitive equipment regardless of line voltage fluctuations or load changes. There is a STABILINE to fulfill the needs of most applications. Let us give you more facts.

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Send STABILINE Bulletin S351 ☐

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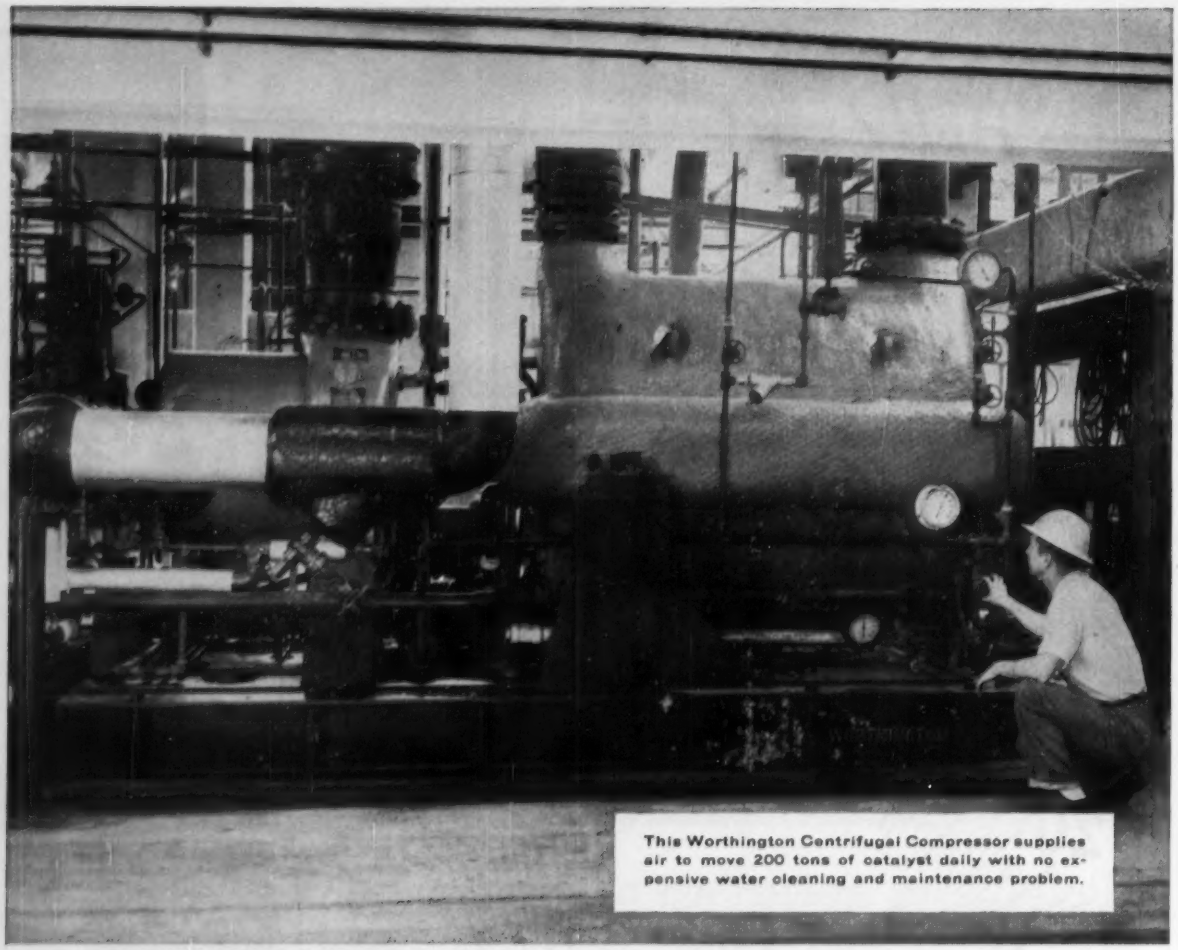

This Worthington Centrifugal Compressor supplies air to move 200 tons of catalyst daily with no expensive water cleaning and maintenance problem.

Process compression without diaphragm and water supply problems

Perhaps your processing can be compared to this operation at Cities Service Refining, where heavy gas oils are catalytically cracked into fuel gas, propylene, and butylene for alkylate and butadiene production, high octane gasolines, and light fuel oils.

Here's an example of low-cost, high-volume processing, with a Worthington GUR centrifugal unit compressing the air to move 200 tons of catalyst per day in a trouble-free, economical manner.

The costly diaphragm and exchanger maintenance problem inherent in the operation of an ordinary compressor is unknown with the Worthington GUR. At Cities Service's Lake Charles refinery, the Worthington centrifugal operates with 95° F. air at 100% relative humidity and 14.5 psia suction pressure, and discharges at 61 psia, 450° F., with a capacity of 4,875 CFM. The compressed air is used to transfer and aerate the catalyst. The temperature of the compressed air is controlled by means of interstage liquid injection, an exclusive development that reduces the heat of compression without employing external heat exchangers. It is powered by a dependable Worthington steam turbine. Cities Service reports, "Governing and control are excellent, and in all other respects it is very satisfactory."

If you'd like the same satisfaction for your process compression or refrigeration, write your Worthington District Office or Worthington Corp., Air Conditioning and Refrigeration Division, Section A6101, Harrison, New Jersey.

A-6.101

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CITRIC ACID. An important chemical in many metal cleaning pastes and liquid formulations for both home and industrial use. Solutions of citric acid, partially neutralized with ammonia, are excellent rust and scale removers. Their use results in the least possible loss of metal. Moreover, citric acid has an extremely low order of toxicity.

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CONDENSER TUBE CLINIC

Edited by **ARTHUR W. TRACY**, Metallurgical Engineer,
The American Brass Company, Waterbury, Connecticut

Stresses and their Effects can be Minimized

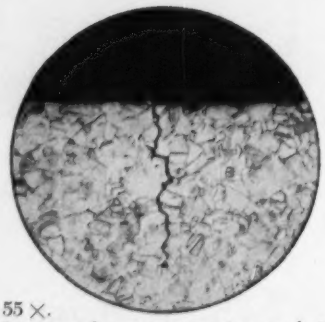
STRESS-CORROSION CRACKING—The stress-corrosion cracking of copper alloys requires the simultaneous action of moisture, air, ammonia, and stress. Stresses may be residual or applied. All Anaconda condenser tubes are processed so as to minimize residual tensile stresses which may be formed during fabrication. Applied stresses from installing tubes in heat exchangers, nonuniform thermal expansion in tube bundles, or misalignment of condensers with other equipment occasionally cause stress-corrosion cracking.

Admiralty metal and aluminum brass tubes, although known to be susceptible to stress-corrosion cracking, seldom crack in condensers. Although ammonia is often present, either by chance or design, in vapors entering condensers, the amount of air (oxygen) is usually so small that the corrosive action of the ammonia is limited. It is obvious that noncondensable gases should be vented from condensers, not only to increase thermal efficiency, but to minimize corrosion.

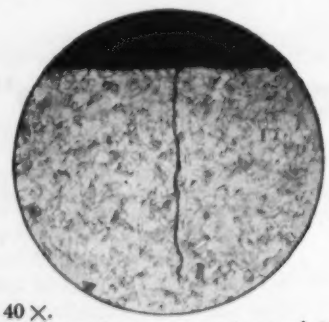
ANACONDA Arsenical Admiralty-439 and ANACONDA Ambraloy-927 condenser tubes seldom stress-corrosion crack in normal service. Where operating conditions are severe enough to cause stress-corrosion cracking of these alloys, ANACONDA Cupro Nickel, 10%-755 and ANACONDA Cupro Nickel, 30%-702 tubes are recommended.

FATIGUE CRACKING—Vibrations from moving parts of equipment or from pressure pulsations can induce stresses in condenser tubes high enough to exceed the endurance limit and cause a fatigue-crack failure. Vibration of a tube may even disturb water flow enough to cause impingement pitting at the point of greatest amplitude of vibration and the resulting pits can act as stress raisers. Pulsations can often be dampened by placing baffles or grids in the path of high-velocity vapors. Vibration of tubes can also be dampened by placing wooden slats between rows of tubes. Cupro Nickel, 30%-702 Tubes are more resistant to fatigue cracking than admiralty and aluminum brass.

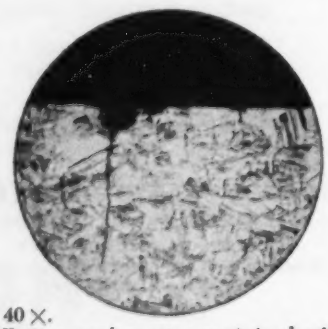
TECHNICAL ASSISTANCE—Your tube problem may need special consideration. We are always ready to advise in the selection of the right alloy to give the best service. Write for the new edition of Publication B-2. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5872



55 ×.
Intergranular stress-corrosion crack in 70/30 brass tube from oil refinery heat exchanger. Longitudinal section.



40 ×.
Transgranular stress-corrosion crack in admiralty metal tube from oil refinery heat exchanger. Longitudinal section.



40 ×.
Fatigue crack starting at pit in aluminum brass tube from power plant condenser. Longitudinal section.

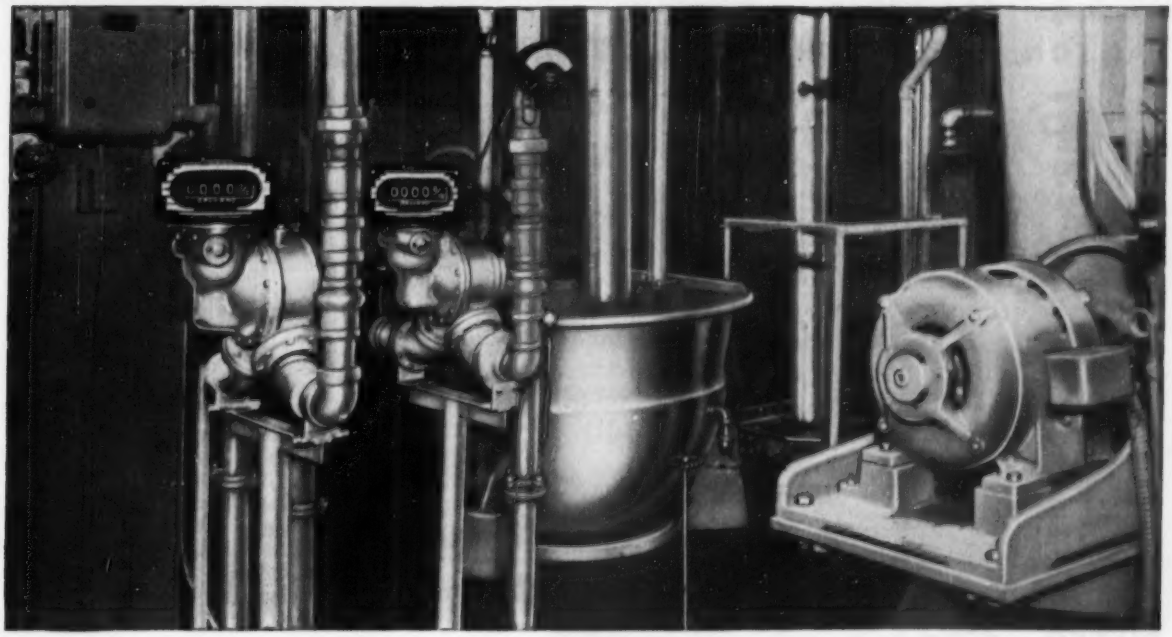
ANACONDA® **Tubes and Plates for Condensers and Heat Exchangers**

Nominal Compositions of Some Anaconda Condenser Tube Alloys

	Arsenical Admiralty -439	Ambraloy -927 (Aluminum Brass)	Cupro Nickel, 10%-755	Cupro Nickel, 30%-702
Copper, %	71	77	88.35	68.90
Nickel, %	..	..	10	30
Zinc, %	27.96	20.96	..	..
Aluminum, %	..	2	..	..
Tin, %	1	..	..	..
Arsenic, %	0.04	0.04	..	..
Manganese, %	..	..	0.40	0.60
Iron, %	..	..	1.25	0.50

Rockwell *Stainless Steel* Meters

MEASURE CORROSIVE LIQUIDS—FAST!



For Foods, Pharmaceuticals, Chemicals and Liquors

These Rockwell meters are constructed *inside and out* of stainless steel. With them you can get positive liquid accounting over a multitude of fluids that cannot be measured by ordinary meters. You can use them *with profit* to cut liquid handling and processing costs, to guard the quality of your end products, to stop losses. And your accountants will welcome these meters for cost control and tax analysis purposes. Get full facts now. Use the handy coupon—or write for bulletins.

Use For All These Purposes

- Liquid Delivery Control
- Formula Control—Cost Control
- Product Quality Control
- Departmental & Inventory Control

NOW AVAILABLE

Automatic Pre-Set Meter Shut-off *without shock.* All stainless construction. Just pre-set the quantity to be measured, then meter and automatic valve take over to shut-off flow in three (3) smooth successive stages without harmful hydraulic shock.

-------CLIP COUPON MAIL TODAY-------

ROCKWELL MANUFACTURING COMPANY
Pittsburgh 8, Pennsylvania DEPT 104G

Gentlemen:

I am interested in measuring _____ (Name of Liquid)

Pipe Size _____"

Working Pressure _____ psi Temperature _____ °F max.

Max. Flow Rate _____ gpm Min. Flow Rate _____ gpm

YOUR NAME _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

COOPER ALLOY CORPORATION BRIEFS

VANTON OFFERS THREE PLASTIC LINES

Ⓟ-LINE Ⓢ-LINE Ⓝ-LINE

Vanton Pump & Equipment Corp. announces the availability of three basic plastic lines to meet varied pipe, fitting and valve requirements. The three lines combine to offer excellent corrosion resistance, non-contaminating properties, high mechanical performance and superior temperature resistance. Full details of the Ⓟ-line (unplasticized, unmodified PVC), Ⓢ-line (Styrene-Copolymer) and Ⓝ-line (Buna N) products are described in Catalog PL-101.

PLASTIC, SELF-PRIMING FILTER PUMP

Filtering corrosive solutions, where metal contact must be avoided, very often presents a problem. Sethco Mfg. Co. of Brooklyn, New York, has solved it with an all plastic, self-priming filter pump, which uses a filter fabricated from Lucite, Saran, PVC or Polyethylene and filter tubes of Cotton, Dynel, Porous Stone or Porous Carbon.

Sethco completes this unique portable package unit with the use of a Vanton plastic "flex-i-liner" pump. Here, as in the filter, liquid never touches any metal but only plastic or synthetic parts suitable for the specific application. As the Vanton pump has no stuffing box or shaft seal, contamination is impossible.

Sethco currently produces these units from 50 to 200 GPH in capacity. Larger units forthcoming. Details on request.

WHAT'S IN A WORD!

The dictionary defines "certified" as "endorsed authoritatively," but to users of Cooper Alloy "Certified" Stainless Steel valves it means: . . . an accurate record of the heat from which the body or bonnet was cast . . . an accurate record of the chemical analysis from test bars poured from the same heat . . . an accurate record of results based on test pieces which accompany every heat treated load. When you see "certified" on a stainless steel valve, you know you are buying the best.

UNIFORM MIXING WITH ADJUSTABLE PITCH AGITATOR

The lack of uniformity of paper stock, in the stock chests, can present a variety of difficulties both in the finished product and in maintenance problems along the line.

The Mixing Equipment Co., Inc. of Rochester, New York has come up with an adjustable pitch propeller type agitator specifically applicable for mixing paper stock. It insures a flow of even consistency pulp to the paper machine offering better control of the uniformity of the finished sheet and reduces down-time of the machine. Variation in consistency of the stock throughout the entire chest can be predicted to a tolerance of less than one tenth of one percent. These special units are now made in sizes in six inch increments from 3 ft. to 15 ft. with Cooper Alloy stainless steel castings specified for the propellers, impeller hubs, and stuffing box castings.

COOPER ALLOY EXPANDS FACILITIES

Expansion of facilities at the Hillside and Clark plants of Cooper Alloy Corporation has been announced by President Harry A. Cooper. Construction which may exceed a half million dollars is already underway.

The expansion at the Hillside plant will provide for major increase in production of fittings, valves and castings by permitting installation of new automatic, high speed equipment. The extension of facilities at Clark are designed to speed the production of rolled and welded aircraft rings.

COOPER ALLOY
CORPORATION • HILLSIDE, N. J.

Divisions:
FOUNDRY PRODUCTS DIVISION · VALVE & FITTING DIVISION · VANTON PUMP & EQUIPMENT CORP.
STAINLESS ENGINEERING AND MACHINE WORKS DIVISION · AIRCRAFT PRODUCTS DIVISION

Know more about motors...

USE THIS HANDY APPLICATION GUIDE TO SELECT

Century

Performance-Rated® MOTORS

Putting Performance-Rating to work...

...is an important step in improving the performance of driven equipment. Only if the motor fits the speed, power and operating requirements of your equipment, can you be sure of top performance and trouble-free service.

Century's unusually wide range of size, speed, frame and torque characteristics makes possible countless combinations ...one of which will be precisely right for your particular application.

Choosing a Century motor, Performance-Rated to fit your job, is a matter of minutes when you use this handy Application Guide...

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- TYPE
- HORSEPOWER RANGE
- RPM RANGE
- SPEEDS — CONSTANT / MULTI-SPEED / ADJUSTABLE
- STARTING CURRENT
- STARTING TORQUE
- CHARACTER OF LOAD
- TYPICAL EQUIPM... BEST SUITED

MECHANICA...

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GET YOUR FREE COPY of this useful Century Performance-Rated Application Guide ...simply mail this coupon:

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Performance-Rated®
MOTORS
1/8 to 400 H. P.

C

CENTURY ELECTRIC COMPANY
1806 Pine Street, St. Louis 3, Missouri
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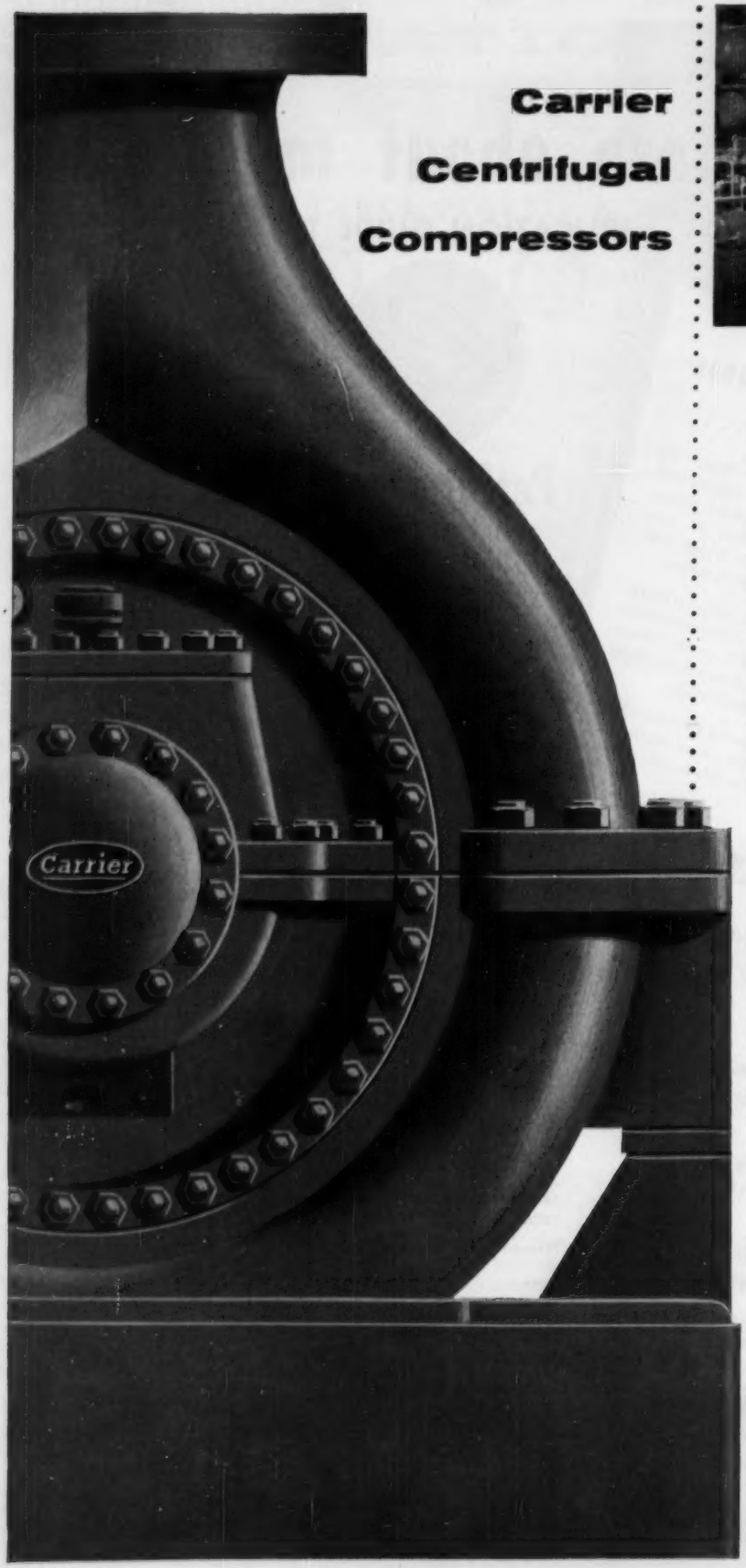
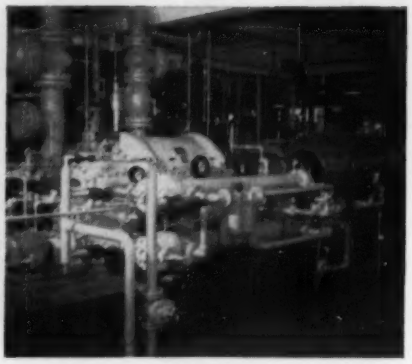


Carrier Centrifugal Compressors



on the job at

Canadian Petrofina Limited

Two Carrier Centrifugal Compressors are on the job at the Pointe aux Trembles plant of Canadian Petrofina Limited. One of the two 800-hp machines serves as a recycle compressor in the production of high-octane gasoline from low-grade naphtha. The other compresses hydrocarbon vapors released from the reactor during the alkylation process and plays a vital role in producing gasoline of very-high-octane rating.

Carrier makes a complete line of centrifugal and axial flow compressors for gas compression and refrigeration —up to 10,000 hp in a single unit. Hundreds of these dependable Carrier machines are on the job at dozens of chemical plants and refineries across the country—such as Olin Mathieson Chemical Corporation, Standard Oil Company of California, Wyandotte Chemicals Corporation, The Texas Company. May we assist you?

If you'd like a copy of our booklet, **"Centrifugal Compressors for Industry,"** please call your nearest Carrier office. Or write Carrier Corporation, Syracuse, New York.

Carrier

centrifugal compressors
refrigerating equipment

POSITIVELY EXCLUDES LIQUIDS, FUMES . . .

APPLETON

INDUSTRY'S MOST ADVANCED LINE

"ST" SERIES CONNECTORS*

for Liquid Tight Flexible Conduit

Why APPLETON "ST" Series Connectors Are Better

Precision turned compression nut (A) slips over liquid tight conduit. Brass Ferrule (B) screws into conduit with sleeve covering conduit. Tightening compression nut onto connector body (C) provides a positive seal and ground between flexible conduit and connector.

Cross section of completed connection shows how tapered end of nut compresses ferrule wall . . . seals perfectly and gives positive ground between conduit and connector.

The Only Fittings of Their Kind . . . Provide Positive Wiring System Protection

• APPLETON *"ST" Series Connectors* have an exclusive brass ferrule, and unique construction to make it your best connector buy for use with liquid tight flexible conduit! Nothing to come loose, deteriorate, crack or break. APPLETON *"ST" Series Connectors* stay tight . . . positively exclude liquids, fumes, chips, shavings and other foreign matter from electrical systems. Recommended by many electrical engineers. And, since the threaded brass ferrule screws in and crimps on there is *a perfect seal* and *permanent* ground . . . maintaining voltage in ground circuit unfailingly within 10 millivolts drop. *"ST" Series Connectors* are one more reason why APPLETON is . . .

TODAY, MORE THAN EVER . . .

The Standard for Better Wiring

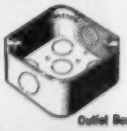
*Patent Applied for

Sold Exclusively Through Selected Wholesalers

APPLETON ELECTRIC PRODUCTS

Also Manufacturers of:

Explosion-Proof Fixtures


Outlet Boxes

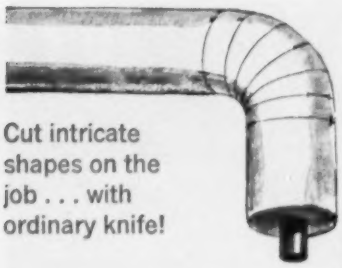
"MF" Series Connectors

Industrial Lighting

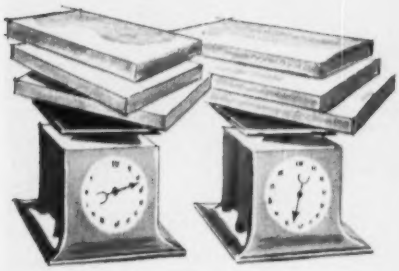
Malleable Iron Unilet Fittings

APPLETON ELECTRIC COMPANY • 1742 Wellington Avenue • Chicago 13, Illinois

new source of high quality lime
...quicklime and hydrate
West End, supplier of quality chemicals for over 31 years, proudly announces expansion of its hydrate and quicklime production. Discovery of an extensive deposit of high grade limerock resulted in the construction of a large new processing plant. The photo shown here is of the giant 340 foot rotary kiln. The plant will soon be producing increased quantities of highest quality lime to serve the needs of growing western industry. We suggest you give consideration to West End as a primary source of supply. Inquiries and your specifications are invited.
WEST END
West End Chemical Company
SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME
EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIFORNIA • PLANT, WESTEND, CALIFORNIA



Cut intricate shapes on the job . . . with ordinary knife!



Versatile . . . available in densities from 2½ lbs. to 10½ lbs. per cu. ft.!

Can be removed for easy line inspection . . . replaced without damage, waste!

FIBERGLAS* and KAYLO®

INDUSTRIAL INSULATIONS

. . . distributed by approved Fiberglas distributor-contractors . . . offer the most versatile family of plant insulations available, in the widest range of shapes, sizes and thicknesses for every type of industrial application. With new *pink* Kaylo-*20* serving the extra-high temperature ranges, you can now order—from *one* reliable supplier—complete insulation coverage *from lowest sub-zero to 1800° F.!* See *Sweet's File, Chemical Engineering Catalog*, or *Refinery Catalog*. Or write Owens-Corning Fiberglas Corporation, Dept. 97-G, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

*T.M. Reg. Owens-Corning Fiberglas Corporation
®T.M. Reg. Owens-Illinois Glass Co., Inc., mfr. of Kaylo

Specify

OWENS-CORNING
FIBERGLAS

Industrial Insulations

for ease of fabrication!

Photo: Courtesy of Alco Products, Inc.

Positioning unplated vessel into place for plating its interior with a durable coat of nickel. By prolonging the useful life of process equipment, nickel plating pays for itself over and over.

Nickel plating protects product purity ...is economical

Economical protection against mild corrosive attack is provided by nickel plating of reasonable thickness.

Equally important, plating safeguards product purity during production cycles.

Records show that considerable savings have been made by processors of food, chemical, petroleum and scores of other products through use of nickel-plated equipment.

Complex shapes now no problem

Heretofore, electroplating was limited to small, simple forms. Large complex shapes posed several difficulties. But no longer, thanks to technical advances along with expansion and improvement of facilities.

Today, new techniques permit plating the most intricate shapes with a uniform, extremely hard, corrosion-resisting nickel coating. Even those of low-cost base metals.

Dependability of these advances has made it practicable to nickel-plate large quantities of equipment to meet exacting demands of the Atomic Energy Commission. And, likewise, to meet the needs of processors.

Investigate how nickel plating can save you money...by protecting your equipment from corrosion and your product from contamination. Also, by cutting the initial cost of your equipment. Send us details of your metal difficulty. We'll be glad to give you suggestions based on long practical experience. Write today.

INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

Why put up with down-time in Concentration Control?

Foxboro DYNALOG* Conductivity Systems assure continuous operation

There's no need to risk costly process interruptions caused by conductivity cells with easily-damaged electrodes . . . or with instruments requiring slidewire maintenance. Foxboro DYNALOG Conductivity Systems eliminate all this. They're designed to give continuous, troublefree service under the most rugged industrial conditions!

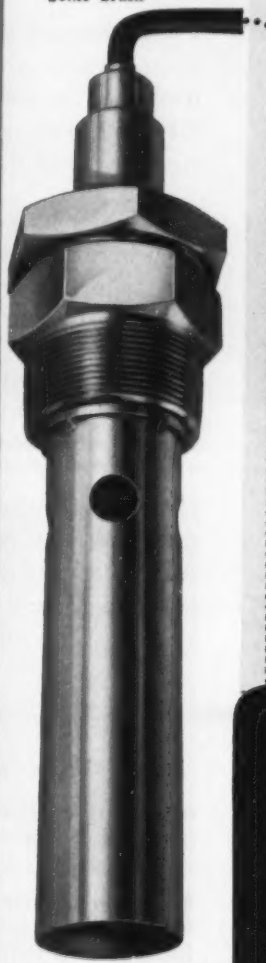
A unique, fool-proof cable seal protects all Foxboro Platinum Electrode Conductivity Cells against leakage at pressures up to 125 psig — even when completely immersed. The electrodes are imbedded in Pyrex glass tubing, flush with the inner surface. They can't clog or obstruct flow . . . cell can be safely and quickly cleaned with a bottle brush. The DYNALOG Measuring Instrument has a simple variable capacitor and positive magnetic drive for instant, stepless balancing action. It assures unequaled accuracy, sensitivity, and speed without wear. What's more, the DYNALOG's 1000-cycle voltage applied to the conductivity cell minimizes polarization effects . . . greatly reduces platinizing maintenance.

Foxboro Conductivity Systems are available for measurement or control from 0-1 micromho to 0-2 million micromhos with linear calibration for a practically limitless number of concentration ranges. Write for full details. The Foxboro Company, 367 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U.S. Pat. Off.

Troublefree Cell Design

- Leakproof — even at 125 psig
- Exclusive flush-mounted electrodes won't clog or obstruct flow
- Easily cleaned with bottle brush



Immersion-type Cell with Stainless Steel Housing

All-glass immersion type also available for use under atmospheric pressure. For measurements under 10,000 micromhos, specify Foxboro Carbon Electrode Cells.

Troublefree Instrument Design

- No slidewire maintenance
- No motor maintenance
- 1000 cycle cell excitation voltage

FOXBORO

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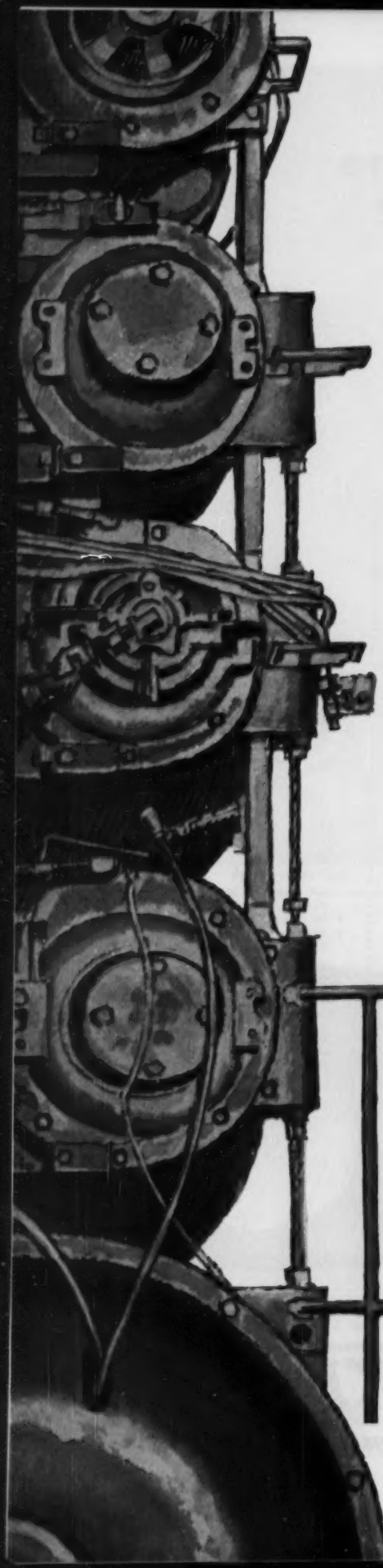
CONDUCTIVITY MEASUREMENT AND CONTROL



To the mill executive who decides on lubricants—

Three good reasons for specifying STANOIL Industrial Oil

1 The increased demand for paper products results in machinery being operated at speeds higher than rated capacity. Continuous production has placed greater burdens on lubricating oils. Without the best lubrication, equipment failures may occur. Best idea is to specify STANOIL Industrial Oil.

2 Cost of repairs and replacement of parts added to the loss of production, run many times the cost of lubrication. A small investment in STANOIL Industrial Oil is the best possible protection against bearing failures, repair costs and production loss.

3 STANOIL Industrial Oil can be used in a multitude of applications. Inventories of lubricants can thus be reduced and the danger of lubrication failure due to misapplication can be cut or even eliminated.

Get more facts about STANOIL from your nearby Standard Oil lubrication specialist. There is one near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick Facts About STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—Inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, is resistant to temperature change. Lubricates in both high and low temperature service.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

STANDARD OIL COMPANY
(Indiana)

STANDARD

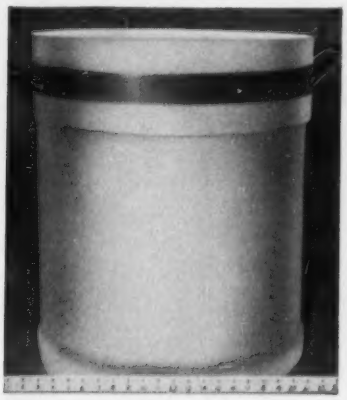
DU PONT

Better Things for Better Living ... through Chemistry

CHEMICAL ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Heat exchanger handling strong nitric acid utilizes property advantages of Du Pont TEFLON®



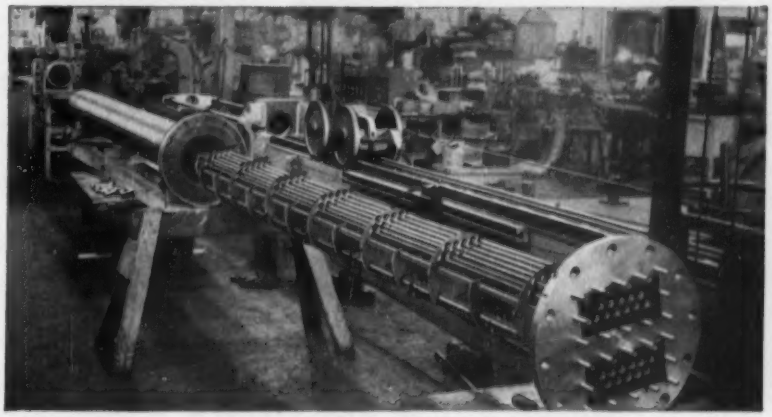
Tanks made of ALATHON® are portable and chemical-resistant

This 40-gallon-capacity tank developed by the American Agile Corporation, Cleveland, Ohio, is made of ALATHON polyethylene resin. The steel band and handles, which are used to carry the tank, were sandblasted and sprayed with a 1/16" coating of ALATHON to make the entire unit corrosion-resistant.

ALATHON has unusual resistance to chemical reagents. It is substantially unaffected by concentrated hydrochloric or hydrofluoric acids at room temperature. While permeable to certain organic acids and to some solvents and essential oils, it is not altered chemically or mechanically by these materials. The chemical and physical properties of ALATHON remain unchanged with age, assuring long, trouble-free service. ALATHON is light in weight, yet strong and flexible, can be readily heat-welded and is available in the form of film, sheet, tubing, pipe or molded products. For the complete facts on ALATHON, mail coupon.

NEED MORE INFORMATION?

Clip the coupon for additional data on the properties and applications of these Du Pont engineering materials.



This heat exchanger, manufactured by Fansteel Metallurgical Corporation, North Chicago, Illinois, raises the temperature of strong nitric acid (42-50%) to 350°-375°F. One of the few metallic materials able to stand this strong oxidizing agent is tantalum; one of the few non-metallics is TEFLON.

A blade of TEFLON driven by a steel shaft covered with TEFLON is used in this new agitator designed by John L. Dore Co., Houston, Texas, for stirring corrosive mixtures under pressure. TEFLON replaced conventional glass-covered agitator, because it eliminated the problem of chipping and breaking.

TEFLON tetrafluoroethylene resin was chosen for two critical uses in this U-tube-type heat exchanger: for the grommets, inserted in the steel baffles to support the tantalum tubes, and in the form of rectangular gaskets at the header, or tube sheet.

In the grommet application, TEFLON not only supports the tubes but insulates them electrically from the steel baffle, preventing galvanic action which might damage the tantalum. TEFLON withstands the temperature of 150 to 190 psig steam, and its low coefficient of friction allows free movement of the tubes with expansion and contraction.

The gaskets of TEFLON must serve as insulation, as well as provide an acid-tight seal. The fact that TEFLON is not subject to damage from thermal shock is also important in this application.

To receive complete property data on Du Pont TEFLON tetrafluoroethylene resin, clip and mail coupon.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department
Room 257, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec

Please send me complete property and application data on Du Pont TEFLON ☐ and ALATHON ☐.

I am interested in evaluating these materials for

_____

_____

Name _____

Firm Name _____

Position _____

Type of Business _____

Street Address _____

City _____ State _____

Unibestos...the only single-layer pipe insulation that provides positive protection at the joints

Unibestos is the only single-layer pipe insulation that's built with the strong, long interlacing fibers of Amosite, the quality asbestos from South Africa. This unique construction permits single-layer Unibestos to form positive heat seals at hard-to-insulate joints and fittings...to provide more protection against heat loss than other single- or even double-layer insulations.

With Unibestos on the job, there is less shrinkage...more resistance to moisture, acid and chemical fumes...greater toughness to withstand shock and vibration. Easy to miter, easy to cut, this durable insulation goes on the most complex pipeline systems quickly and economically.

Fast, low-cost application...long-lasting, positive protection —these are the reasons why Unibestos is becoming the specified insulation for more and more of today's industrial operations. Unibestos® is available in sectional form through 44" O.D.

Joe Bestos says:

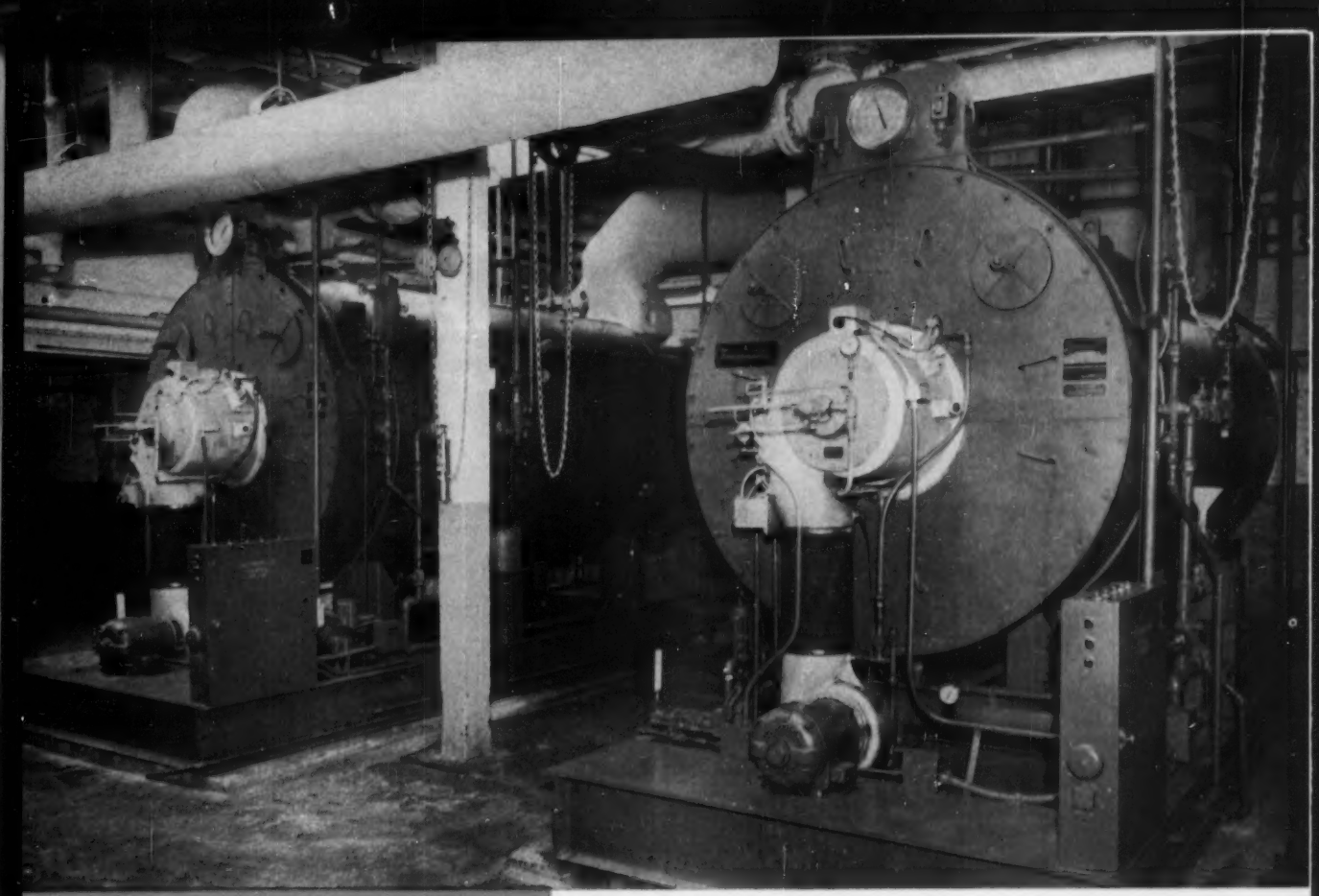
Remember when insulating those tough fittings, single-layer Unibestos locks in more heat than other single- or double-layer insulations!

For complete information write...

UNARCO

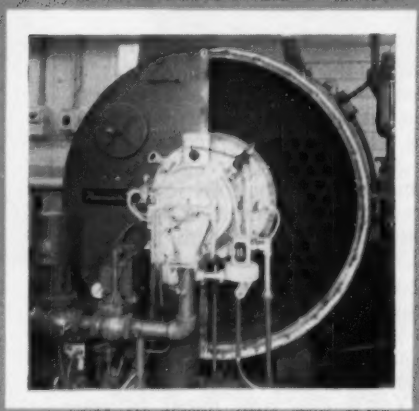
UNION ASBESTOS & RUBBER COMPANY

1111 West Perry Street • Bloomington, Illinois



WHY TWO?

Powermaster® PACKAGED AUTOMATIC BOILERS



Time-saving inspection and cleaning of *Powermaster* is provided by easy removal of sectioned front cover without disturbing burner, accessory equipment or piping; by convenient handholes; and by easily removable rear cover. This simple and complete accessibility is a big advantage in maintaining clean, efficient operation over the entire life of *Powermaster* units.

● Major operating advantages are gained by installing two or more *Powermasters* rather than a single large boiler. These include greater assurance of a constant steam supply, increased flexibility of operation, more efficient light load standby, reserve capacity for extra-heavy load demands and for rapid expansion, greater freedom from downtime for inspection and maintenance.

Sizable cost economies also are effected because of *Powermaster's* simplified installation, space-saving compactness, automatic time-saving operation, fast steaming and quick response to load swings, high fuel economy at all loads, maintenance-saving accessibility and other service-proved features.

These are reasons why multiple *Powermaster* installations are now serving numerous manufacturing industries, institutions, public buildings, schools, housing projects, laundries, military posts and other steam users.

Be sure you take a close look at *Powermaster* advantages whenever you're looking for a dependable, low-cost steam supply for any plant or building requirement. Ask for Bulletin 1220.

Powermaster®

PACKAGED AUTOMATIC BOILERS

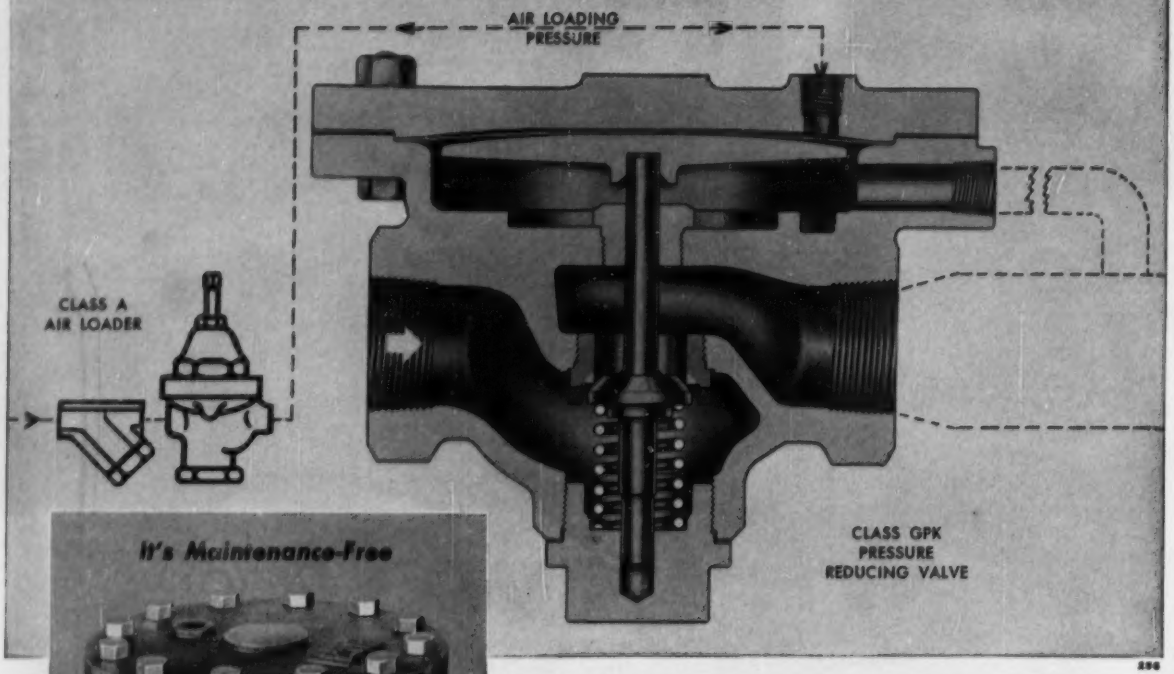
Sizes to 500 hp.; pressures to 250 psi

Builders of Dependable Boilers Since 1885

ORR & SEMBOWER, INC.

Morgantown Road, Reading, Pa.

No maintenance inspection on this new valve until 1959!



You can just put this amazingly simple and compact Leslie Class GPK-A pressure reducing valve on the line and forget it for at least 3 years!

YES, AND THAT'S A *GUARANTEE* backed by a reputation for quality established in more than half a century of design, development and manufacture of regulators and controllers.

This amazing new, diaphragm operated, Leslie pressure reducing valve has *only two moving parts:* no seals; no stuffing boxes; no small, dirt-catching parts.

A simple air loader eliminates the conventional bulky loading spring and provides accurate diaphragm loading that gives pilot-type response. Yet, it is rugged and uncomplicated. The unit itself lends itself readily where remote adjustment is an advantage, too. And you pay no price premium for these advantages. You get Leslie quality for about the same initial cost as leading makes of ordinary regulators.

Suitable for any steam service up to 250 psi, 450°F, the unit is available in ½" to 2" sizes. It is ideal for intermittent service too, and is unaffected by dirty steam.

Your Leslie engineer can give you all the data on this amazing valve. You'll find him listed in your classified directory under "Valves" or "Regulators".

Send for YOUR copy of Bulletin 561 today.

TRADE LESLIE MARK

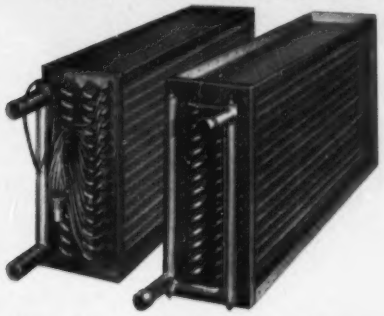
REGULATORS AND CONTROLLERS

LESLIE CO., 279 GRANT AVENUE, LYNDHURST, NEW JERSEY

MARLO HEAT TRANSFER EQUIPMENT

NOW AVAILABLE IN STAINLESS STEEL TO YOUR SPECIFICATIONS

HEATING and COOLING COILS

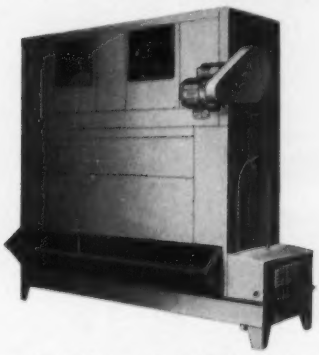


Stainless—Continuous plate type with staggered tubes and smooth drawn ferrules pressure-expanded to produce a highly effective positive mechanical and thermal bond between tube and fin. Also available with copper and aluminum tubes and fins in any combination.

COOLING TOWERS

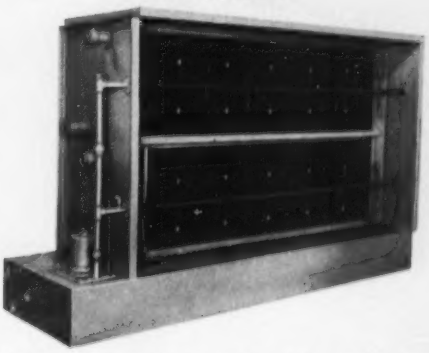
Stainless—2—150 tons. Suitable for indoor or outdoor location. Quiet operating.

EVAPORATIVE CONDENSERS



Stainless—3—150 tons. Suitable for indoor or outdoor location. Quiet operating. All prime surface condensing coil.

AIR WASHERS



Stainless—Compact and sectional in construction, for quick, easy erection. Available in many standard sizes, also custom designed for special applications.

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CONTROL SYSTEM

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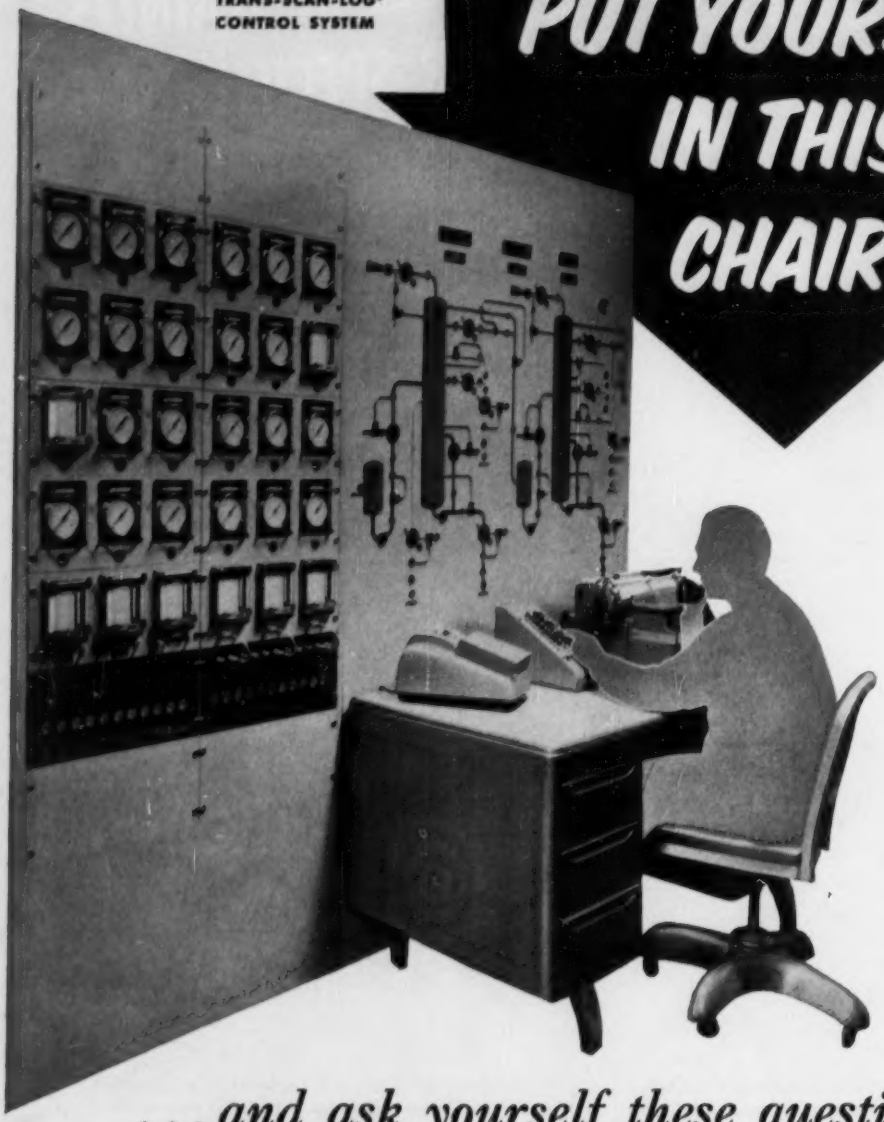

. . . and ask yourself these questions

Is scanning and logging, as I understand it, economically justified?

Perhaps not, if you're thinking just of mechanical logging of all variables, which gives little more than an accurate historical record of what has happened. But the new Taylor TRANS-SCAN-LOG System makes the operator more than a score-keeper. It enables him to instantly *visualize, evaluate* and *act upon* every processing irregularity as it occurs — without leaving his desk in front of the panel.

What effect would the TRANS-SCAN-LOG System have on my control room space and operator requirements?

It will take approximately 60% of the space normally required by a standard graphic panel *without* scanning and logging. The compactness of this "intelligence center" enables operator to supervise a greater percentage of the process. Because the scanning and logging equipment is an integral part of the process control, one operator can identify and correct any off-normal condition, as well as having a continuous trend record.

Where can I see this unit in operation?

We cordially invite you to come to Rochester to see this complete data collecting system in operation, because we believe that its many unique features *do* make it economically justified.

Your Taylor Field Engineer will be glad to make the necessary arrangements. In the meantime, write for **Bulletin 98268.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

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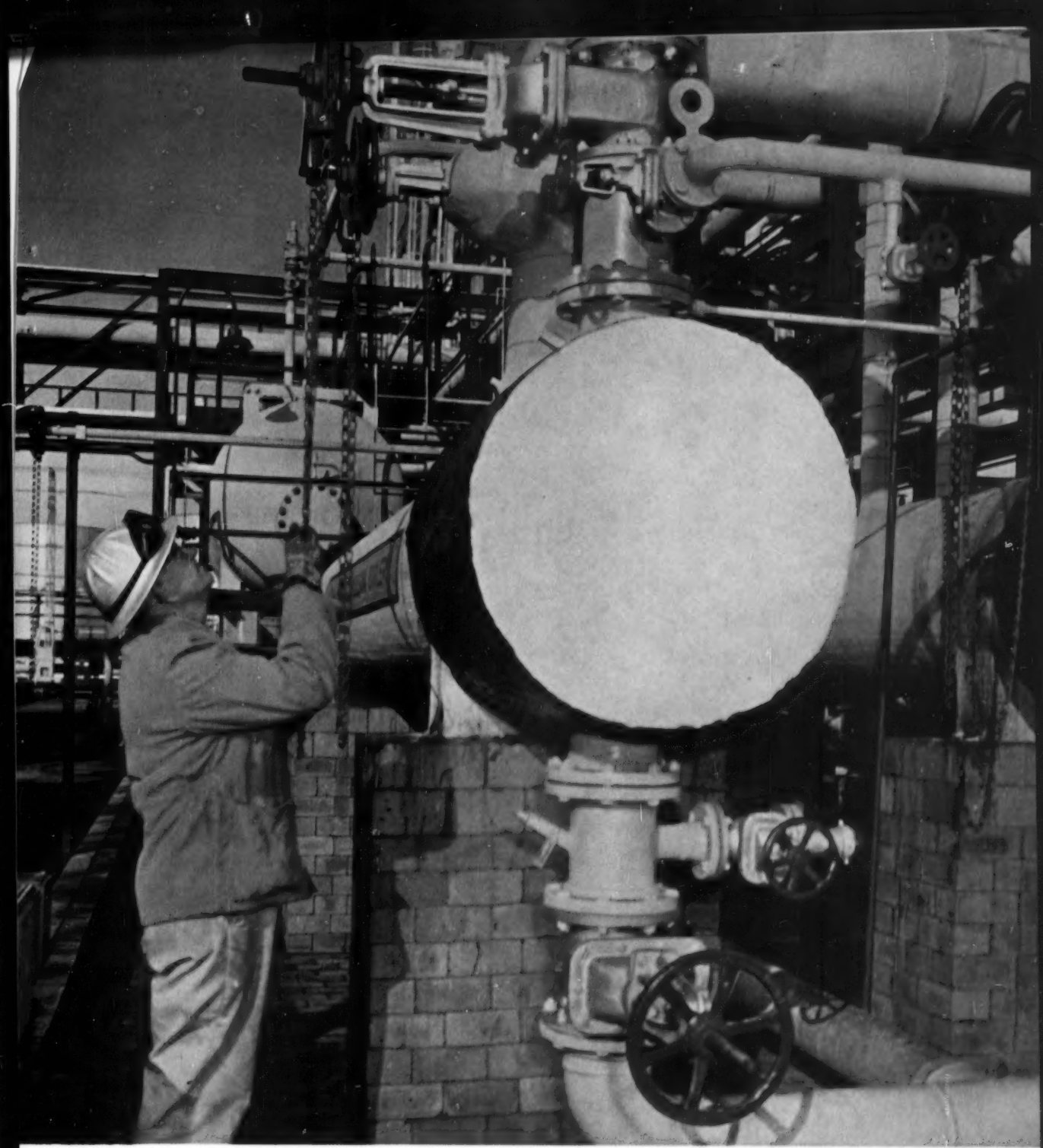
Taylor Instruments
MEAN ACCURACY FIRST



Closing the gate on hard-to-hold hydrocarbons

At Esso Standard Oil's Bayway Refinery light hydrocarbons are used extensively at a wide range of temperatures and pressures.

Light hydrocarbons are hard to "hold," but the self-adjusting wedge design on Aloyco gate valves insures tight shut-off. Corrosion-resistant Aloyco valves – like the red-wheeled, chain-operated gate valve above – are used throughout many process units.

You'll see many more of them on key jobs at leading petroleum, processing and chemical plants throughout the country. What about your corrosives-handling problems? Write Alloy Steel Products Company, Inc., 1301 West Elizabeth Avenue, Linden, New Jersey.

6.2

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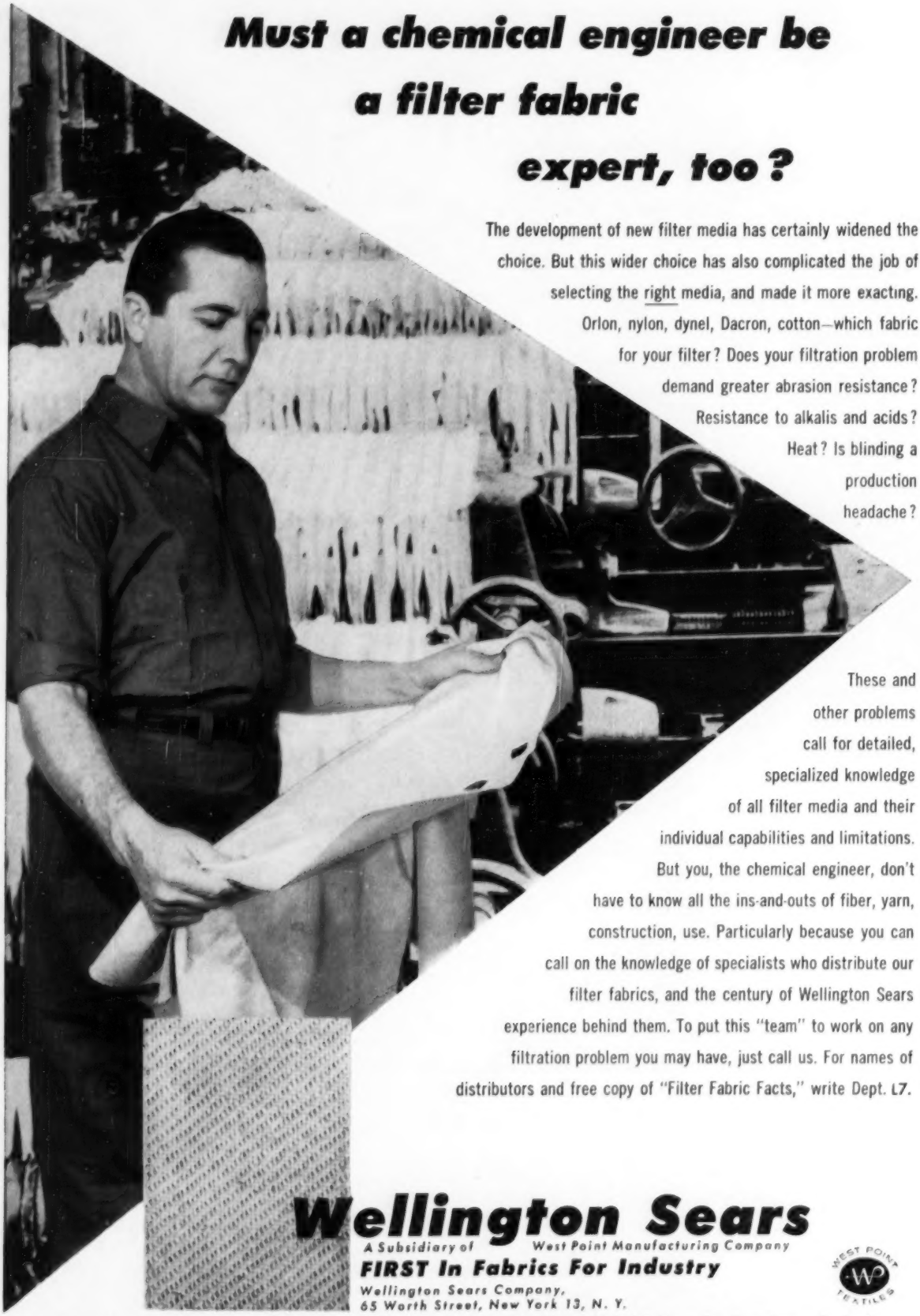
Must a chemical engineer be a filter fabric expert, too?



The development of new filter media has certainly widened the choice. But this wider choice has also complicated the job of selecting the right media, and made it more exacting. Orlon, nylon, dynel, Dacron, cotton—which fabric for your filter? Does your filtration problem demand greater abrasion resistance? Resistance to alkalis and acids? Heat? Is blinding a production headache?

These and other problems call for detailed, specialized knowledge of all filter media and their individual capabilities and limitations. But you, the chemical engineer, don't have to know all the ins-and-outs of fiber, yarn, construction, use. Particularly because you can call on the knowledge of specialists who distribute our filter fabrics, and the century of Wellington Sears experience behind them. To put this "team" to work on any filtration problem you may have, just call us. For names of distributors and free copy of "Filter Fabric Facts," write Dept. L7.

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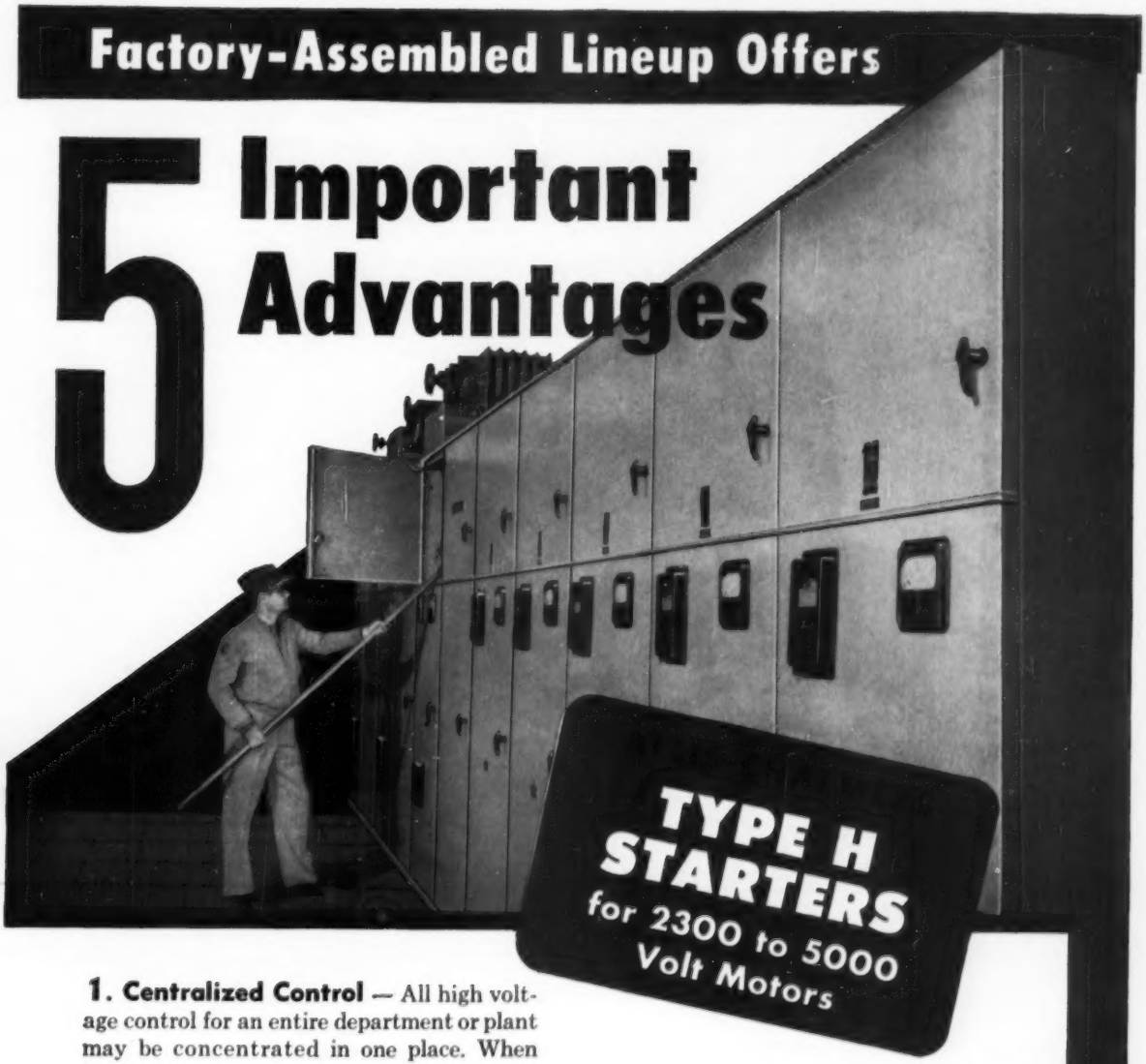

1. Centralized Control — All high voltage control for an entire department or plant may be concentrated in one place. When located in a separate control room, starter lineup operates in cleaner atmospheres. It also may be made inaccessible to unauthorized personnel.

2. Low-Cost Installation — Control group is factory-assembled *and bussed*. Conduit layout is greatly simplified. For example, lineup requires only one incoming power feeder.

3. Simplified Expansion — Internal bus and convenient wiring provision plus standardization of cubicle size facilitate addition of starters. Each starter unit is self-contained. Expanding the lineup is merely a matter of adding a starter and connecting the bus.

4. Attractive Appearance — Uniformity of cubicles presents a modern, streamlined appearance.

5. One-Company Responsibility Complete responsibility for assembling proper control devices and for control performance rests with Allis-Chalmers. A-4704

For complete information, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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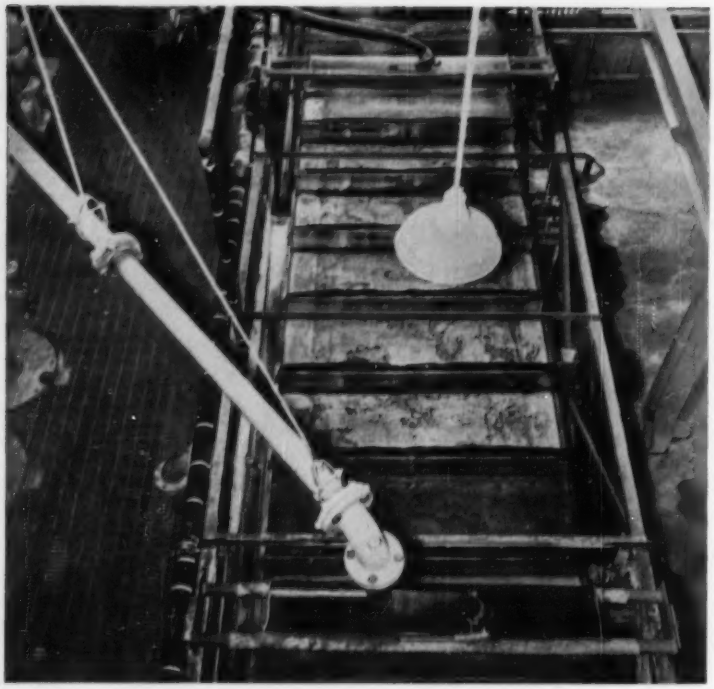


New tray filters benefit from better designs as . . .

H_3PO_4 Processing Sets Pace

Tray filters gain acceptance in wet-process phosphoric plants for difficult gypsum-H_3PO_4 separation.

There's no mystery about what's needed: A continuous filter capable of handling large quantities of solids. Cloth blinding is a big problem, so the cloth must be readily accessible for cleaning without shutdown. Filtrate is the valuable product—the filter must use a minimum of diluting wash water.

Ever since commercialization of the wet-process method for phosphoric acid—with its difficult gypsum-H_3PO_4 separation—engineers have been looking for a filter meeting the above specifications. It now looks as if the search is about completed with introduction of the new tray filters.

Two types are available: The traveling pan belt filter (Giorgini) and tilting pan rotary horizontal (Prayon). The traveling pan has trays attached to an endless belt driven by pulleys. Discharge takes place as the belt goes over a pulley. The tilting pan consists of horizontal filter compartments which tilt to discharge cake.

▶Improving Filter Technology—Many designs preceded development of these new filters (from plate-and-frame, through rotary drum vacuum, rubber belt, and rotary horizontal vacuum). None did a completely satisfactory job in wet-process plants.

Recently however the growing fertilizer markets for wet-process H_3PO_4 has spurred work on improved filter designs. New plants and expansions have jumped production 162% during 1950-1955. In 1955 780,721 tons (P_2O_5) of wet process acid were produced.*

*In 1955 wet process acid accounted for 58% of the total phosphoric acid produced in this country. About 81% of w.p. acid goes into fertilizers. The electric furnace process turns out a purer acid, but it's more expensive except where unusually cheap electricity is available.

▶More Work Needed? — Tray filters have all the advantages of the rotary horizontal filter—countercurrent washing, sharp wash separation, flooding of cake with wash liquor. And in addition they keep the filter medium at peak efficiency without shutdown for cleaning.

However some experts say the two designs now available are not the final answer. The traveling pan belt has about 50% idle time per cycle, and the tilting pan is a complicated piece of equipment.

▶Proving Their Worth — Despite this, Missouri Farmers Assn. at the new $5 million concentrated fertilizer (diammonium phosphate) plant at Joplin, Mo. has installed three traveling pan filters for the gypsum-phosphoric acid separation (for a description of the tilting pan see CE, June 1955, p. 205).‡

Each filter consists of 42 individual rectangular stainless pans 6-ft. wide by 2-ft. long. A motor driven shaft powers sprockets which drive chains attached to each pan.

A narrow belt traveling between the chains and directly under the pans serves as a vacuum seal and wear strip.

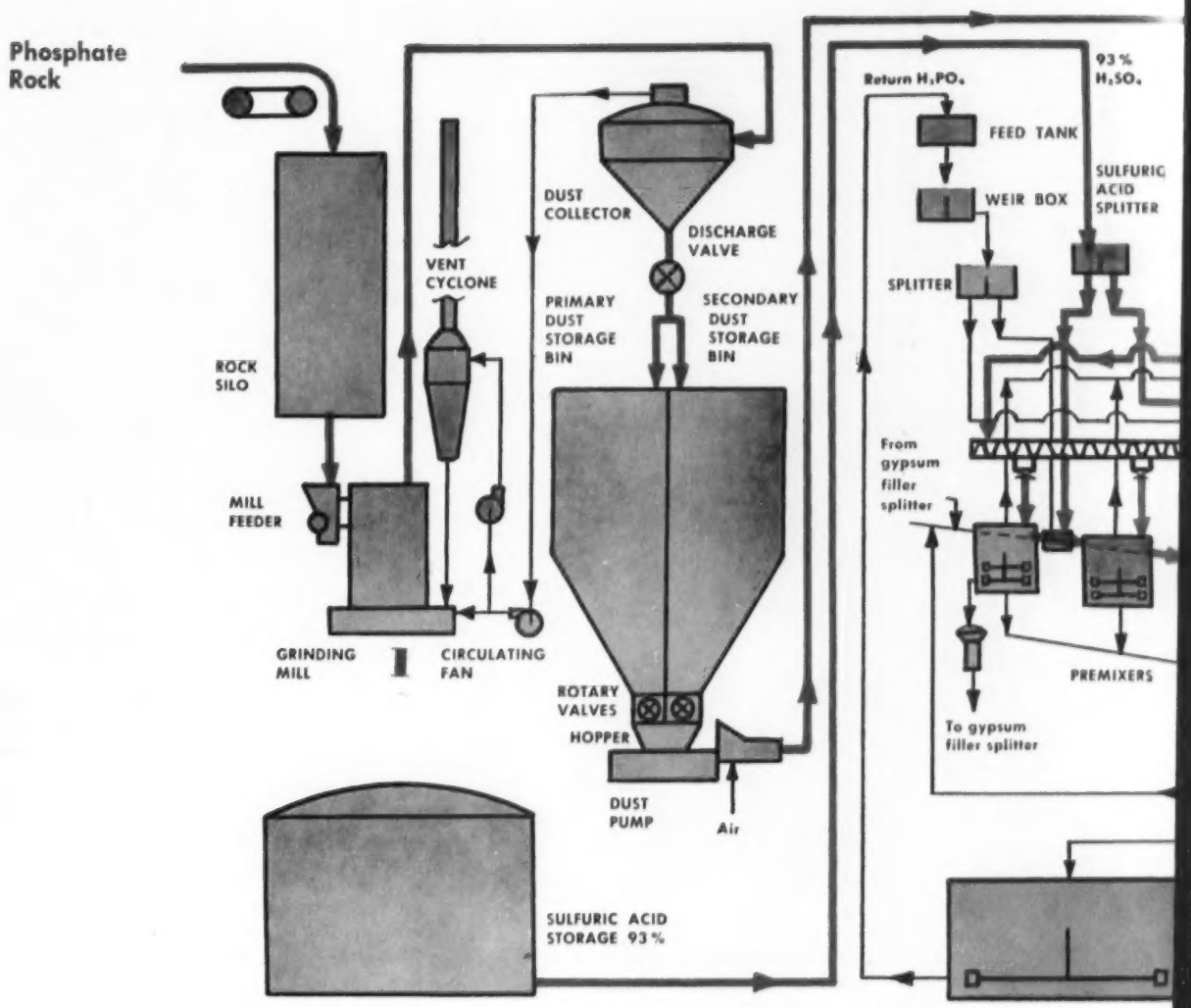
Each pan is divided into two sections. The upper part—where the cake collects and is washed—has an open top. A filter cloth supported by wire mesh separates the lower section from the upper part. This lower section serves as a vacuum chamber.

Pans are attached to a steel plate, which in turn is bolted to the traveling rubber vacuum seal. Below this traveling seal or belt is a stationary enclosed filtrate trough. Slots in the pans, steel plate and belt match a slot extending the trough length.

▶How Vacuum Works — Vacuum is applied to the large enclosed filtrate trough, then to the individual pans through the slots. Filtrate flows to the collection troughs through the slots. The rubber belt or vacuum seal serves as a gasket preventing loss of vacuum.

▶Washing Gypsum—Waste gyp-

‡ This is the second U.S. installation. The other is at Davison's Bartow, Fla., plant. Smith-Douglass at Streator, Ill., and Western Phosphates at Garfield, Utah, use tilting pans.



sum is washed countercurrently starting with fresh water. Filtrate from the first wash is weak acid, which becomes the second wash.

Filtrate troughs have removable partitions for filtrate separation. A strong product acid and two weaker acids are produced and go out through three pipes at the bottom of the trough. These partitions are removable for drawing a single mixed filtrate.

▶**Gypsum Discharge**—Washed gypsum cake discharges by gravity as the pans overturn. Three series of spray nozzles along the bottom of the filter wash any remaining gypsum from the pans and rinse the filter cloth and pans to prevent salt build-up. Usually the filter is taken out of operation every 100 hrs. to wash out filtrate lines and receivers.

The filter belt travels at 15 ft./min., although this speed can be varied depending on the slurry characteristics. It operates under a vacuum of 10-14 in. Hg.

Filter cloth is the synthetic monofilament type, removed by taking out the frame holding the cloth in the pan. Normal capacity is 2.6 tons of dry gypsum per sq. ft. of filter area per day.

▶**How to Make H_3PO_4**—Basically MFA uses the Dorrco strong acid process at Joplin (*see flowsheet*).

Ground phosphate rock reacts with a mixture of 93% sulfuric acid and dilute phosphoric acid in air cooled agitated reactors. This system consists of three pre-mixers (8-ft. dia. by 10-ft. high) and three reactors (14-ft. dia. by 16-ft. high).

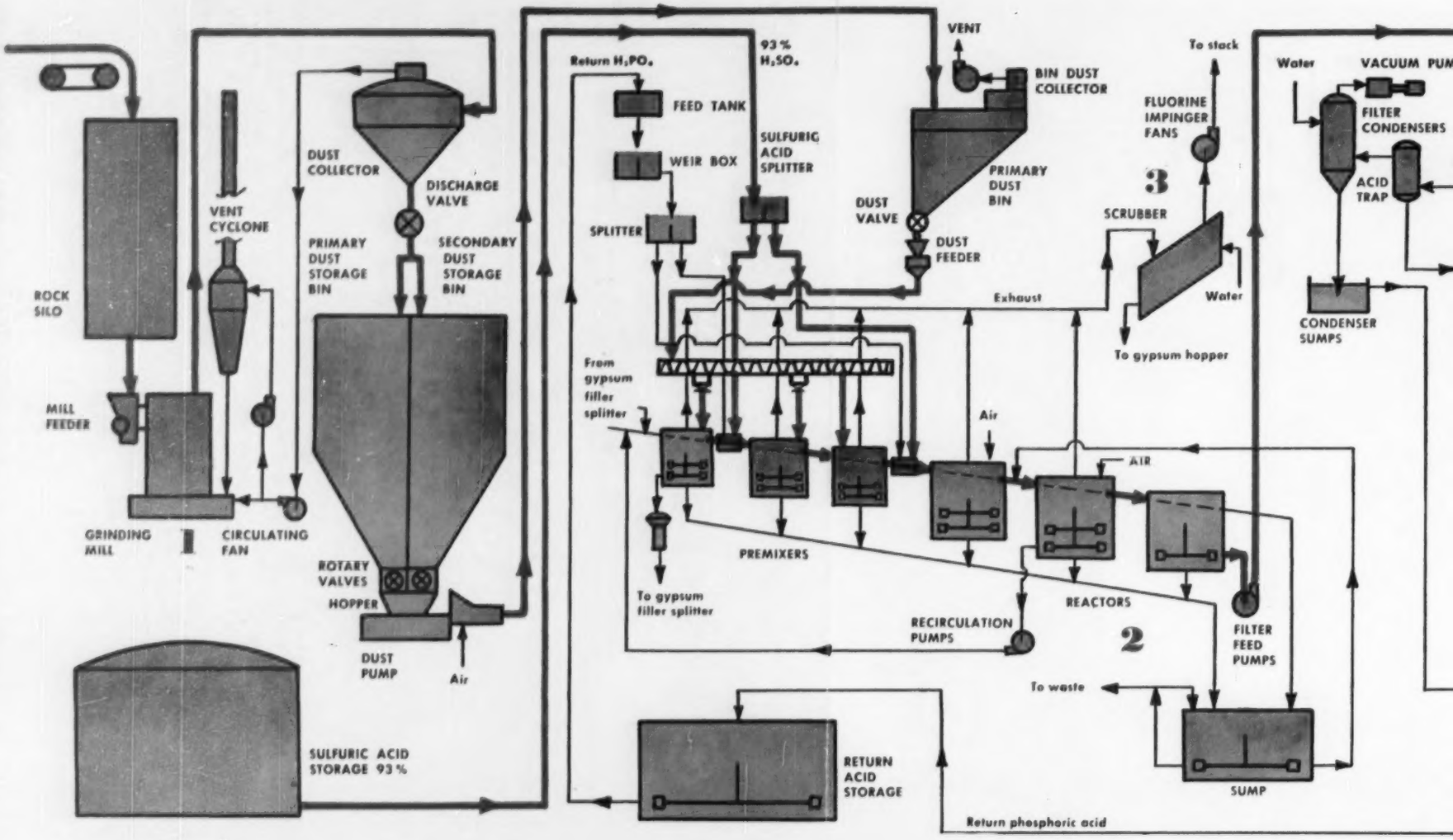
Principal reaction (160 F.) is between tricalcium phosphate and H_2SO_4 to give soluble phosphoric acid and insoluble calcium sulfate. Minor reactions produce HF, fluosilicic acid, iron and aluminum phosphates; all these create severe corrosion problems.

Temperature and concentration is controlled to precipitate gypsum ($CaSO_4 \cdot 2H_2O$) in an easy-to-filter form.

Two water impingement scrubbers (Doyle) remove fluorine from the reaction gases.

▶**Separating Liquid from Solid**—Reaction slurry goes to the TP filters. A dilute acid (32% P_2O_5) mixes with 55% P_2O_5 in a distribution box—this produces a 53% P_2O_5 acid with precipitated impurities. Part of this goes to a clarification tank, then to the fertilizer plant. Part is used as feed to two Swensen single-effect vacuum evaporators.

The plant produces 76.7 tons/day of P_2O_5 and 366 tons/day of gypsum.



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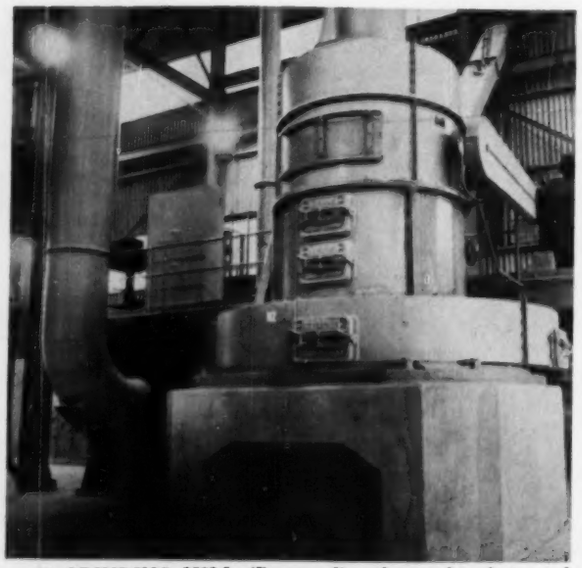
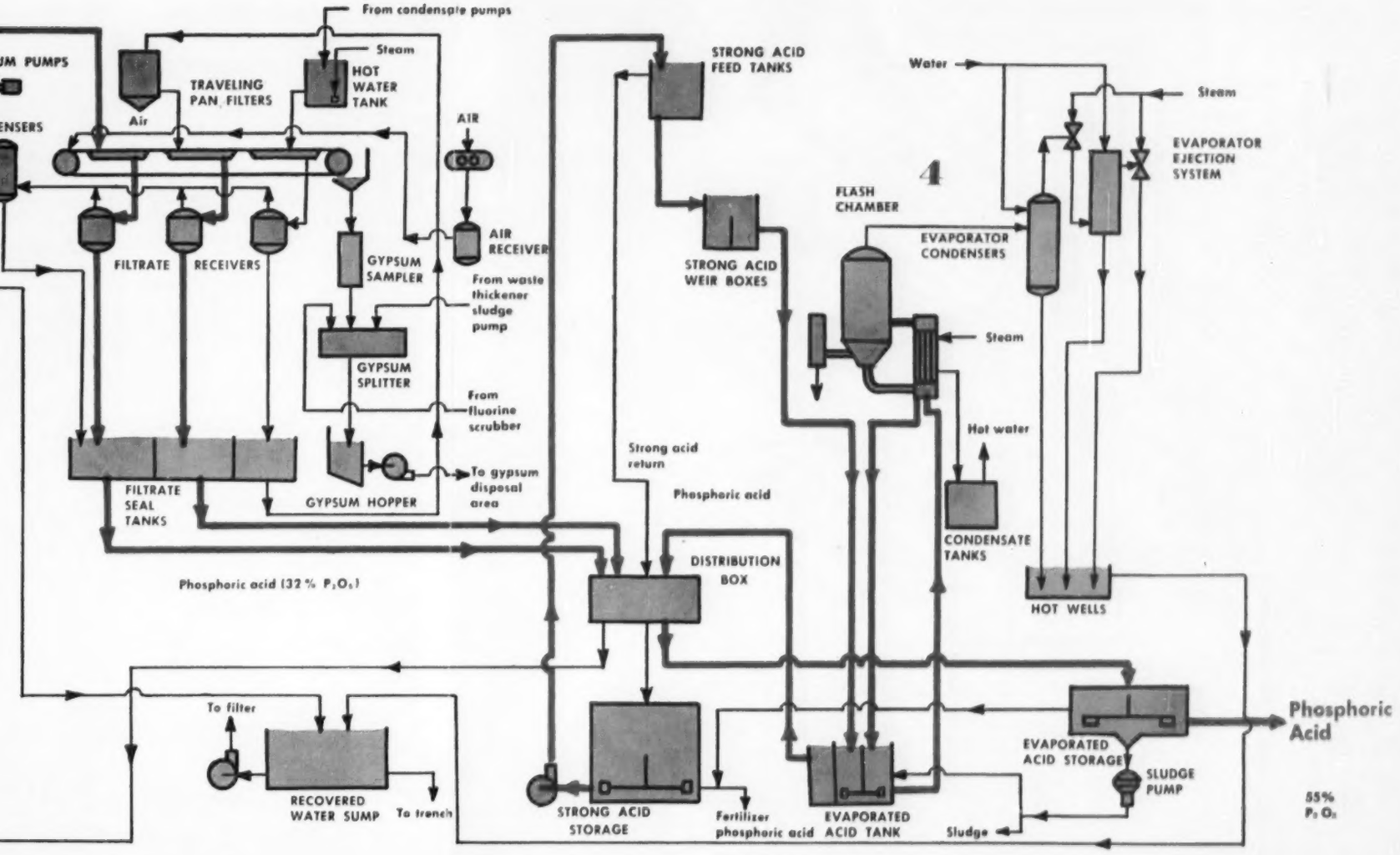
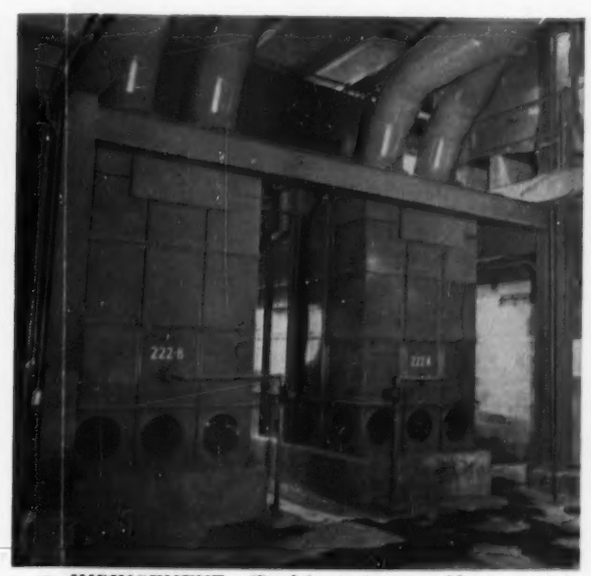


1 GRINDING MILL (Raymond) reduces phosphate rock to granular form. This goes to the reaction system.

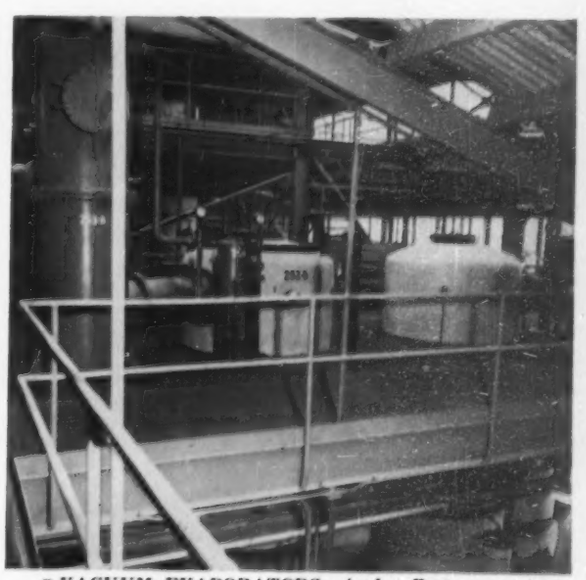
2 REACTION s premixers in f



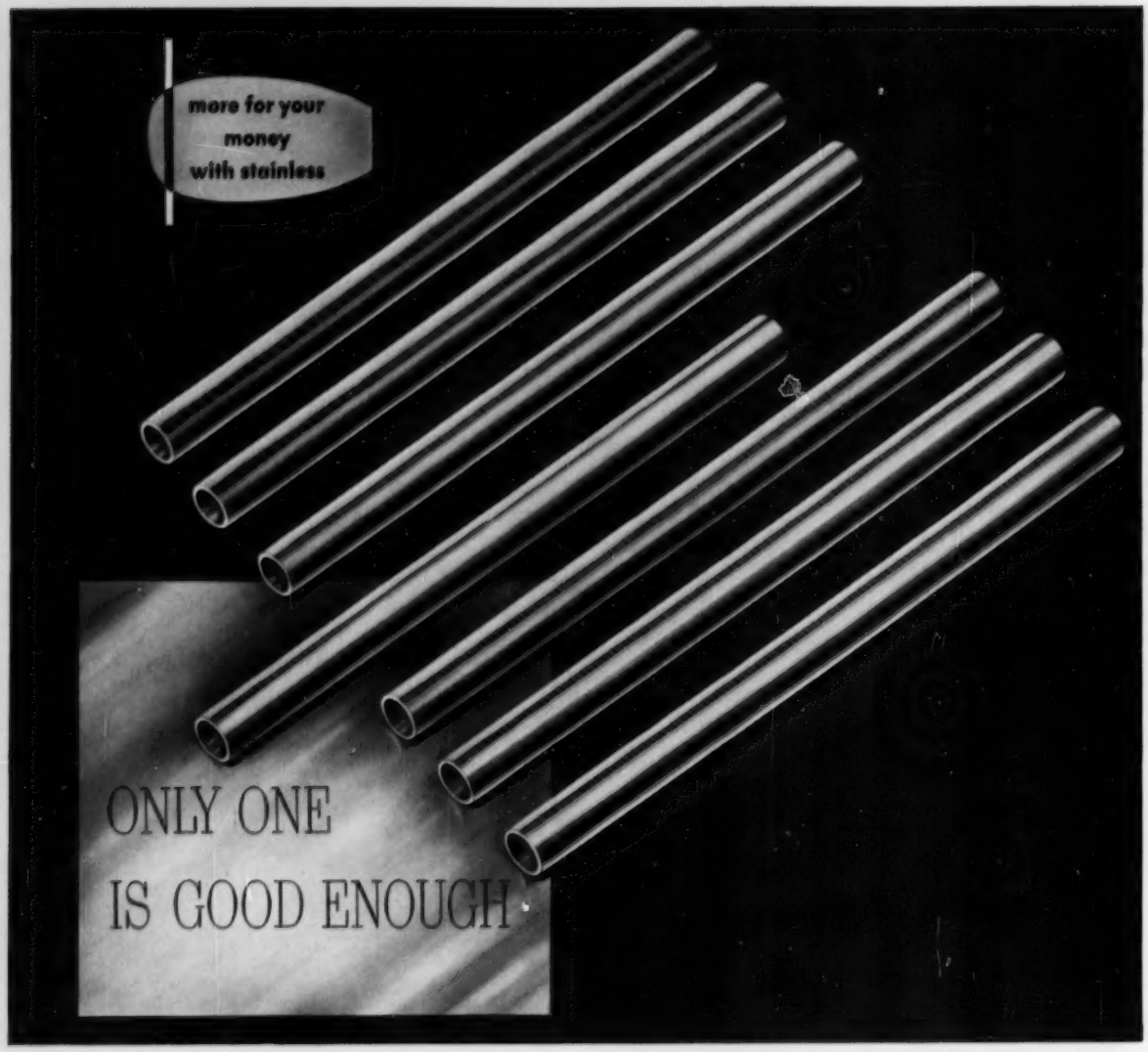
ION system for phosphate and H_2SO_4. Three rs in foreground, three reactors in background.



3 IMPINGEMENT (Doyle) water scrubbers remove fluorine-bearing exhaust gases from reactors.



4 VACUUM EVAPORATORS, single effect, concentrate 32% P_2O_5 acid to about 55% P_2O_5.



The best stainless tubing for a specific application cannot be identified by surface appearance alone. The answer is found in the grain structure. Because your guarantee of satisfactory service rests *inside* the metal, it is most important for the stainless tubing buyer to consider his supplier's methods of manufacture.

Corrosion resistance, which prevents product contamination, depends upon heat treatment. Heat treatment of stainless steel tubing for a specific end use may vary according to grade, size of tube and service requirements involved. For instance, the austenitic grades of stainless steel have optimum corrosion resistance only when all carbides have been dissolved and retained in solution by rapid cooling. At B&W, heat treatment is rigidly controlled, and every piece of stainless tubing is heat treated to provide optimum corrosion resistance when that property is required.

For virtually any application—pressure or mechanical—B&W can provide either seamless or welded stainless tubing in any number of grades, in a broad size range. Help is available through B&W Regional Sales Offices and a nationwide network of experienced tubing distributors. Mr. Tubes—your link to B&W—will be pleased to furnish detailed answers to your stainless tubing problems. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

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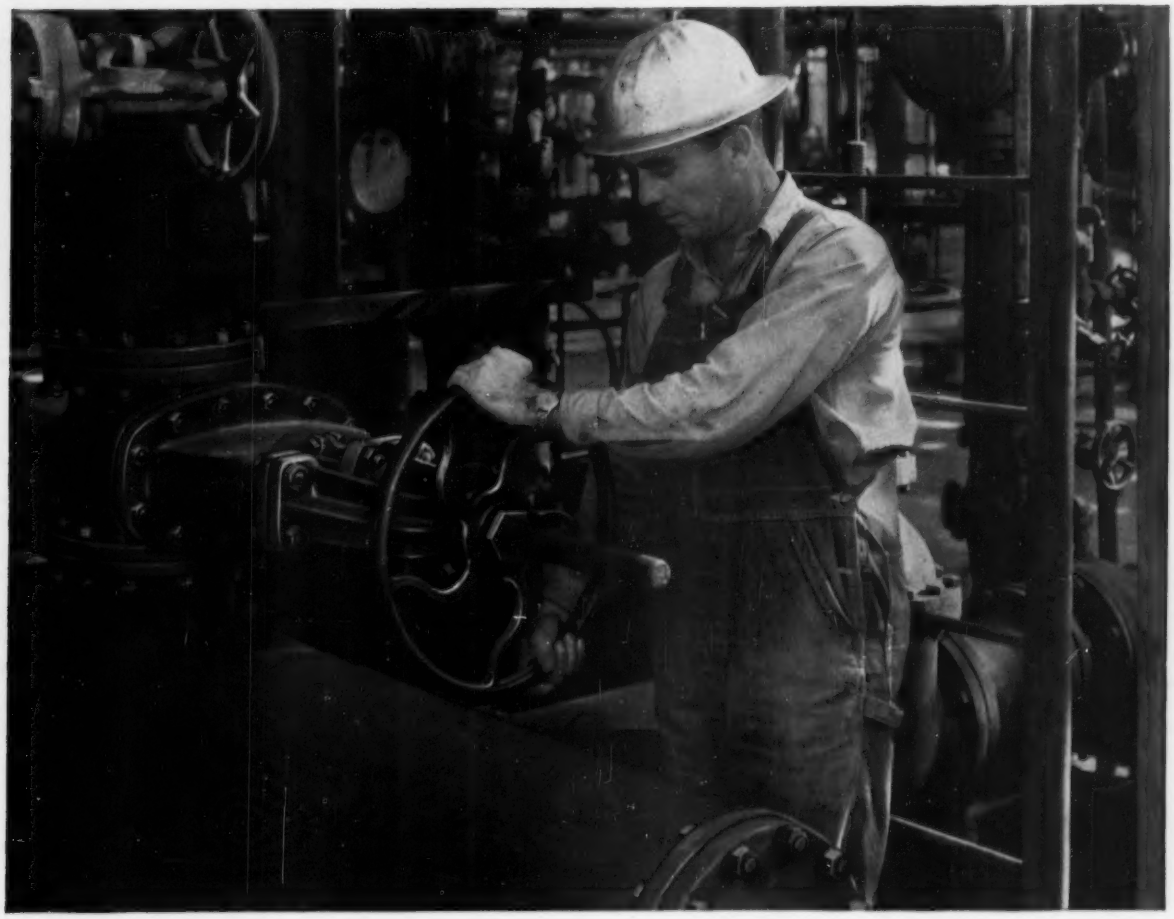

No leakage, no sticking with this Crane valve after 2 years on heavy alkylate at 300° F.

THE CASE HISTORY—How do Crane cast steel gate valves hold up on heavy alkylate? The No. 47X 10-inch, 150-pound valve you see above has been in service at Eastern States Petroleum Co. refinery at Houston for over two years.

It handles re-run bottoms from the H_2SO_4 alkylation unit at 300° F. In addition to erosion from solid carbon, there is mild corrosion present from acid. Valve operation is on an average of once every 1½ weeks.

Not once has Eastern States had to put a wrench on this Crane valve. There has been no leakage, no sticking whatsoever. Closure is tight and sure, and response to the handwheel is as smooth and easy as the day the valve was installed.

Unusual performance? Not for Crane cast steel gate valves. For these valves differ from other valves on the *inside*—where performance stands or falls.

Over a century of skill is back of their sound design and pressure-tight castings, and in the heat treating and finishing of the Crane Exelloy seating. That's why Crane valves are *preferred* for refinery service.

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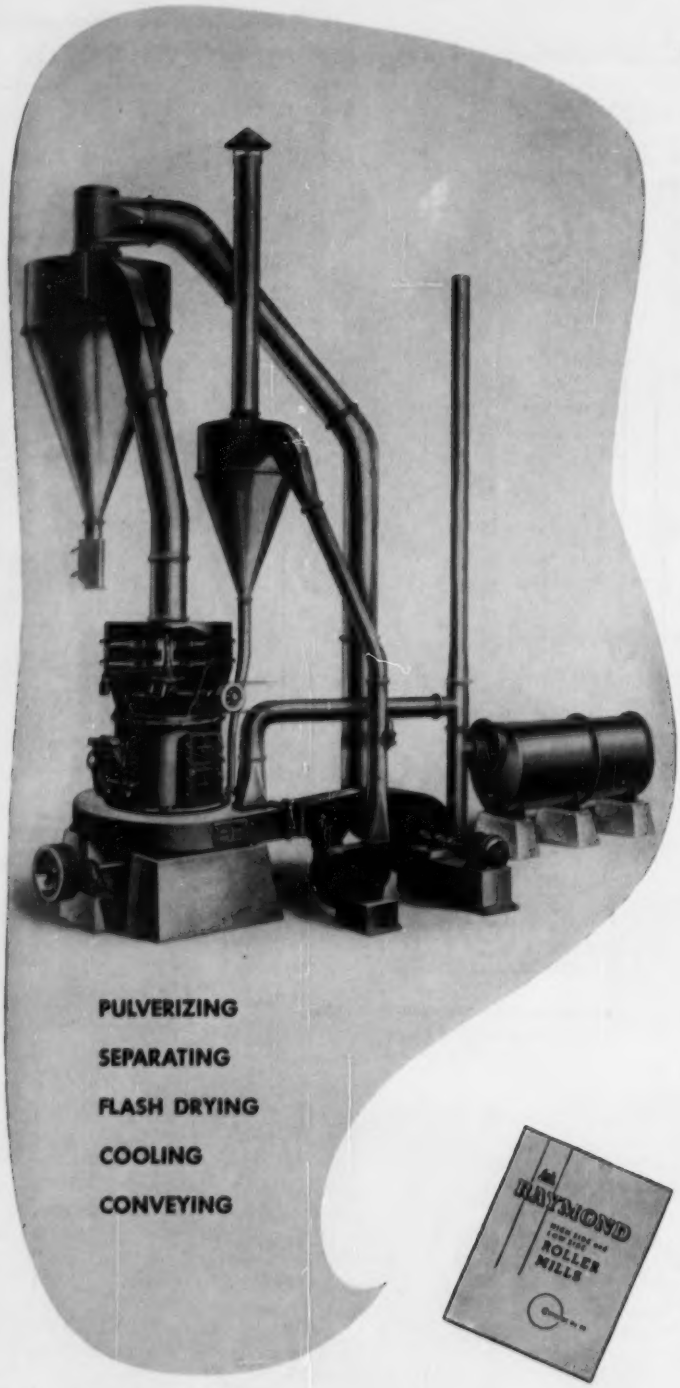

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EDITED BY M. A. GIBBONS

Professors Happel and Treybal . . .

Men of the Month:

Robert Treybal, John Happel

NYU professors lauded by AIChE for authoring chemical engineering literature

Dr. Robert Treybal, professor of chemical engineering at NYU, is the first to win the new Stephen L. Tyler Award of the New York section of the American Institute of Chemical Engineers, given "to recognize outstanding contributions to chemical engineering literature." Treybal received the prize for his book, "Mass Transfer Operations," published last year, by the McGraw-Hill Book Co.

Special mention was given to Dr. John Happel, chairman of NYU's department of chemical engineering for his article "The Venture Worth Method for Economic Balances," which appeared, recently, in *Chemical Engineering Progress.*

▶**Treybal's Book** — Imagining how much the publication of some famous chef's prize recipes would mean to culinary apprentices might give non-technical people some idea of what Treybal's new book means to students—including the perpetual ones—of chemical engineering. His book is a compilation of the unique and extensive lecture notes he has developed over the years while teaching NYU's graduate course in—(what else?)—"mass transfer operations."

And students at the Heights are already showing enthusiasm for the new text. Till now, each man had to rely solely on his own class notes to glean the best out of the course. This was a hand crippling job!

One graduate student describes Treybal's class like this:

The session begins in the evening at 7 sharp; ends at about 9:05. In the interim, Treybal bombards the students with a heap of well-organized material on engineering science and how-to applications.

Treybal and his wealth of information completely awe the class. Students jot down voluminous notes, through various stenographic means, in a frenzied attempt to catch every word. Small wonder that he commands so much respect: they say he works out all the problems throughly for each day's session in advance of class. What's more, his preparation, grasp of the subject and imagination is such that he seems to be aware of what you're thinking. They say he knows what question you're going to ask even before you raise your hand!

Presenting material, his delivery is fast and pointed. It's one of those classes that really piques your interest, forces you to concentrate till your brain curls in a knot. At times, when the class is over, you're so completely thrilled and fascinated by the new material you've grasped that, for once, you think you've really got a hold on the subject. But there are times, too, when you feel so swamped that you stagger out in a limp heap hoping everyone will leave you alone —with your deflated ego.

▶**Protégé**—Some twenty years ago, Henry Masson (former chairman of the chemical engineering department) decided on a long-range program to build up a competent staff. The plan involved selecting and developing a senior or graduate student with an outstanding academic record and personality.

Treybal, with a scholastic (cum laude) average of 97.5% and an expressed ambition to teach and develop students, filled the bill. The school awarded him a fellowship to earn his master's degree and then advised him to spend some time in industry (with Atlantic Refining).

Before long, though, an important vacancy occurred in the department. This involved several courses of an advanced mathematical nature concerning the solution of problems in the area of unit operations. Treybal was notified on a Friday, prepared over the weekend, and was ready to start class on Monday morning.

And since that time, except for a few years with M. W. Kellogg, Treybal has remained on the campus.

By the time he was 27, he had

mixing the Day way at Goodyear.....

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Photo shows two of many Day Blenders being used at the Goodyear Tire & Rubber Co. for mixing a variety of compounds.

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NAMES . . .

earned his doctorate at Columbia as well as an assistant professorship at NYU. At 31, he became associate professor and, only three years later, a full professor —certainly not an ordinary record of advancement. More recently, he served for a time, as acting department chairman. But, as quickly as possible, he gave up administrative chores to give his teaching fuller attention.

▶**Vertical Approach** — As a whole, Treybal's interests and activities are few but well-concentrated and highly intensive. Aside from his teaching schedule, he has published extensively in his field, particularly on solvent extraction. In fact, he probably has spent a good bit of his recent years working with his typewriter. Besides many occasional articles, he regularly turns out an annual progress report on "liquid extraction" for *Industrial & Engineering Chemistry.*

One of his other books—"Liquid Extraction" (McGraw-Hill) will soon need revision. But Treybal doesn't relish the prospect of "hatcheting" his way through this particular writing chore. Such an operation, he says, reminds him of the "unappetizing job of rehashing the leavings of yesterday's turkey."

Granted, Treybal's time is fairly well occupied with his teaching and writing but he does manage to fit a few other items into his busy schedule. He's mighty enthusiastic about his consulting work with Carbide in Niagara Falls. He knows what's going on in the opera world and occasionally relaxes with a bit of water-color sketching. This year, along with his wife and son, he plans to take a leisurely tour of central Europe.

But, if you ask him to talk about himself, he'll probably give you an off-hand underestimate of his work as a whole, say nothing about those classified projects at Carbide and, finally, apologize for what he assumes is a very dull interview!

▶**Special Mention to Happel**—Treybal's cohort in snatching the AIChE honors for NYU is Department Chairman John Happel.

Like Treybal, Happel is a prolific writer. He has authored

numerous articles for scientific journals as well as such sizable projects as a chapter for Clyne's "Engineering Opportunities," another for Dunstan's "The Science of Petroleum" as well as an article for the Kirk-Othmer "Encyclopedia of Chemical Technology."

▶**Industrial Background** — Unlike Treybal, though, Happel has spent many years—17 or more—in industry before coming to NYU.

He began with Socony-Vacuum in 1930. Then, during the War, he was in the thick of the government sponsored activity with developed butadiene. For this he was a member of the technical advisory committee of the Petroleum Industrial War Council and later a member of the Neches Technical Commission, with Neches Butane Products Co. Commission headquarters, in Beaumont, Tex., was the hub of the largest concentration of refining activity in the States—in the midst of Socony, Gulf, Atlantic, Texas and Pure Oil operations.

Many of Happel's convictions on research processes—which he soon hopes to publish—date from this era. It was at this time, that he had an opportunity to compare the progress of various researchers—working independently—toward a similar goal and to note, in each case, the really different, unique lines of thought.

▶**A new Career**—It wasn't till after the war that Happel began to consider teaching seriously. He had always enjoyed working with young groups of trainees and developing them. He recalled, too, his own interest, in undergraduate years, in the ideas of professors who had been out practising the kind of engineering which he was still studying in school. Further, he believed that the best possible America could be realized when young engineers recognized their responsibility to help other nations achieve a better economic standard and thus end the friction between the "have nots" and the "haves."

It was with these factors in mind that he finally accepted the NYU appointment. That was eight years ago. Periodically,

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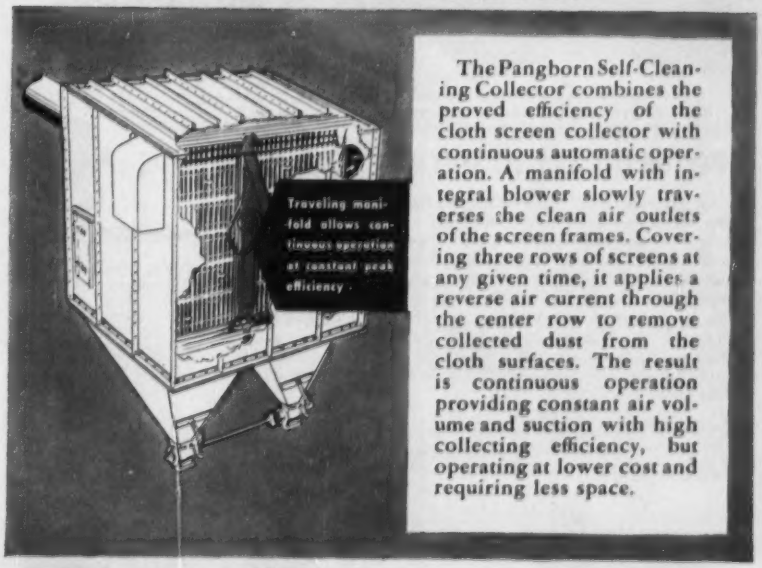

The Pangborn Self-Cleaning Collector combines the proved efficiency of the cloth screen collector with continuous automatic operation. A manifold with integral blower slowly traverses the clean air outlets of the screen frames. Covering three rows of screens at any given time, it applies a reverse air current through the center row to remove collected dust from the cloth surfaces. The result is continuous operation providing constant air volume and suction with high collecting efficiency, but operating at lower cost and requiring less space.

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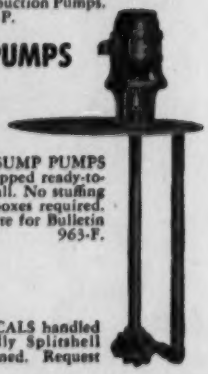

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when he sizes up the pro's and con's of working in industry and in education, he becomes aware, most of all, of the satisfactions of the classroom. He doesn't believe that the change was a mistake—and neither does NYU

Parmelee Honored by Chemical Engineers in New Orleans

Still going strong at 82 is Dr. Howard C. Parmelee, editor of Chemical Engineering's predecessor "Chem & Met" from 1917 to 1928, founder of Food Industries (now Food Engineering) and first consulting editor of McGraw-Hill's chemical engineering series of text and reference books.

Recognizing Dr. Parmelee's long service to the chemical engineering profession, the Council of the American Institute of Chemical Engineers paid him a unique honor during its national meeting in New Orleans.

President Walter G. Whitman presented him with a ruby-studded emblem of the Institute to signalize his services as Secretary of the AIChE from 1927 to 1930. He also praised Parmelee's pioneering role in the Institute's program for accrediting chemical engineering education —a plan that was later adopted for the entire engineering profession by the Engineers Council for Professional Development.

R. C. Halter has been promoted to research specialist at Humble Oil's research and development division.

Keith F. Beal, specialist in ammunition propellants, has been

promoted to assistant manager of the department of chemistry and chemical engineering at Armour Research Foundation of Illinois Institute of Technology.

George W. Hamilton is the newly elected vice president in charge of the amino products div., International Minerals & Chemical Corp. **Nelson C. White** has been promoted to vice president in charge of the potash division.

William R. Smith, former chief engineer of Kaiser Aluminum's reduction plant at Chalmette, La., has been named plant manager of the firm's plant in Tacoma, Wash. **Allen R. Bacon and M. J. Kinsey** are managers for construction of the firm's plants in Ravenswood, W. Va., and Gramercy, La., respectively.

Carl A. Bolez, senior chemical engineering student at Lehigh University has won first prize in the annual AIChE F. C. Zeisberg Memorial Award for excellence in report writing by students in chemical engineering. Second prize went to **Alan L. Stockett,** also at Lehigh.

Webster N. Jones

The former dean of engineering and science and, at present, vice president of Carnegie Institute of Technology—Webster N. Jones—joined Pittsburgh Plate Glass Co. at the end of the academic year in June.

Dr. Jones will be associated with the firm's industrial relations department as advisor on the selection and training of professional personnel.

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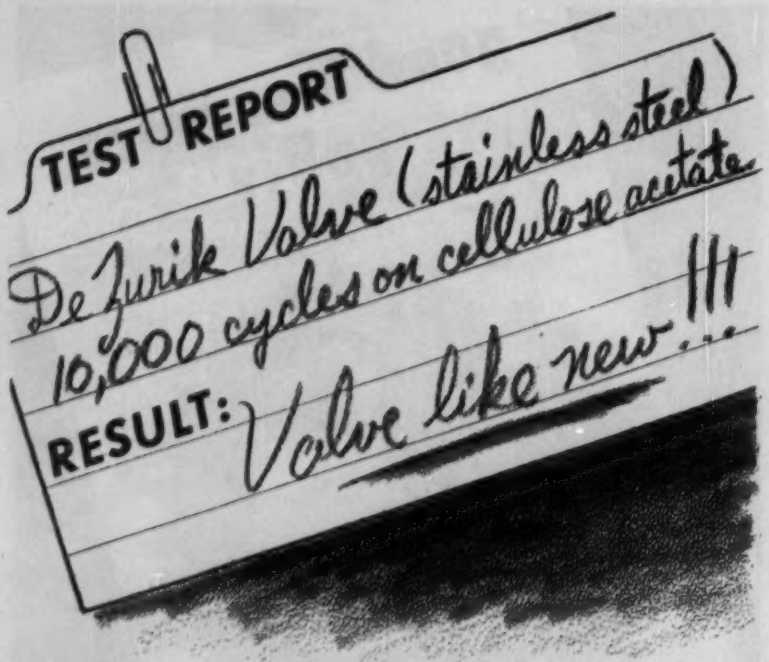
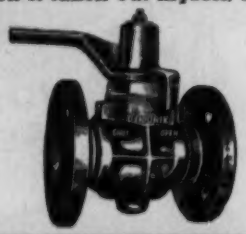
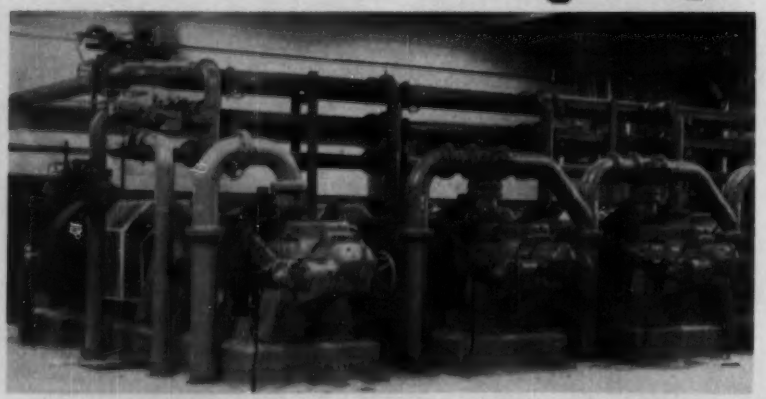


A leading chemical firm recently made a test involving a 4" DeZurik Stainless Steel Valve on a line carrying cellulose acetate. *After 10,000 cycles,* the DeZurik Valve was removed and dismantled. The engineer in charge reported there was no galling or pitting . . . . no deterioration of any kind! "In fact," he said, "if I hadn't seen it taken out myself, I'd say it was a new valve!"

DeZurik Valves consistently rate test reports like this. Their easy, non-lubricated operation guarantees maintenance-free installations. They open wide with a quarter-turn, close dead-tight despite solids in the flow.





The full line of DeZurik Valves includes models in a broad range of materials (also with TEFLON* faced plugs). They can be furnished to operate manually, pneumatically, hydraulically (with or without positioner) and electrically. Get the complete story on DeZurik Easy-Operating, Non-Lubricated Plug Valves. Representatives in all principal cities. Or write Dept. E-7.

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NAMES . . .

Prior to his association with Carnegie Tech, he had managed the general chemistry laboratories of the B. F. Goodrich Co. for eight years. He is an alumnus of the University of Missouri. Following graduation, he taught chemistry at the University of Maine and, later, at the Universities of Montana, Purdue and at Radcliffe College.

W. Roberts Wood

President-elect of the Girdler Co., Louisville, Ky., a division of National Cylinder Gas, is W. Roberts Wood.

Wood joined Girdler in 1929 after an association with Du Pont in Newark, N. J. Ten years later, he became manager of the gas processes division. He was elected vice president in 1941 and executive vice president in 1948. Then, three years ago, he became a vice president and director of National Cylinder Gas.

He succeeds George O. Boomer, who retired as Girdler's operating head. Boomer will continue as chairman of the executive committee of the parent firm.

Gerhard A. Cook has been appointed research laboratory administrator for Linde Air Products Lab in Speedway, Ind. **George Omietanski** has joined the research staff.

Chapin A. Harris, head of Lowell Technological Institute's dept. of fibers and yarns and director of the LTI graduate school, has been selected by the University of Minnesota to assist in the rehabilitation of Seoul Nat'l University during the summer.

A. N. Wohlwend has been named director of commercial

development for Escambia Bay Chemical Corp.

Allen R. Kittleson has been named a senior research associate by the board of directors of Esso Research & Engineering Co. He is responsible for the invention of the fungicide—SR 406.

James B. Bullit, Jr. has been appointed director of research of DuPont's fabrics and finishes department. **Roy B. Davis** was named his assistant. Bullitt succeeds **George Graves** who is now general director of research divisions for the textile fibers department.

Harold A. Levey, Sr. has received the 1956 honor scroll of the Louisiana chapter of the American Institute of Chemists for "his tireless efforts towards the advancement of the profession of chemistry."

Herbert B. Gausebeck

The new manager of European operations for Armour Research Foundation of Illinois Institute of Technology, Chicago, is Herbert B. Gausebeck.

He will head up a "European Technical Observation Group" which has been set up by Armour as a service to American companies to help them keep tabs on European developments.

Twenty non-competing firms are expected to enroll in the plan by the time it goes into operation in this month. Categories of observation will include chemistry, metallurgy as well as mechanical, electrical and chemical engineering.

Gausebeck joined Armour Research in 1948 as supervisor of the plastics section in the chem-

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Examine a Kidde Dry Chemical Extinguisher closely, and you'll see why Kidde is first choice with firefighting experts the nation over. These lightweight extinguishers (for fast, easy aiming) have Kidde's patented diffuser horns which give you up to 44% *more* coverage than you get with conventional dry chemical extinguishers. Dependable and easy to operate, Kidde's special trigger-finger grip permits even a novice fire fighter to tackle a blaze immediately . . . with confidence.

Especially effective in fighting fires in L-P gas, oil, gasoline and other flammable liquids, Kidde Dry Chemical Extinguishers will not pack. Cartridge-operated Kidde extinguishers are available in 20 and 30-pound capacities, while Kidde pressure-operated models come in capacities of 5 and 10 pounds. All Kidde pressurized extinguishers have easy-to-read, dustproof pressure gauges, can be charged to U.L.-approved working pressures (150 pounds) at any commercial air pump. In addition, the 10-pound model can be charged to 250 pounds for extra fire-fighting punch! It is U.L.-approved at either pressure.

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NAMES . . .

istry and chemical engineering research department.

W. B. Strobel

A 1956-57 Sloan Fellowship has been presented to W. B. Strobel, of Continental Oil's petrochemical department. The fellowship involves a year's study under the executive development program at Massachusetts Institute of Technology.

A native of Kansas City, Kan., Strobel received his master's degree in chemical engineering from the University of Colorado. He joined Continental Oil in 1938 and served in various capacities as technical assistant to the manager, petrochemicals; and, most recently, as director of projects development.

Strobel, 33, is the fifth Conoco man in seven years to receive a Sloan Fellowship.

Walter H. Zinn, noted scientist and director of the Argonne National Laboratory, has been presented with a special commendation by the USAEC, for his contributions to the realization of the commission's programs during the past 10 years.

Ross M. Sims has been appointed plant manager in charge of all operations of Allied Chemical & Dye's Moundsville, W. Va., plant. He has been plant superintendent since May 1953.

Ward F. Davidson and **Edward Weidlein** have received top awards from the Air Pollution Control Association. Davidson, recipient of the Frank A. Chambers Award retired last year from Con Edison; Weidlein, who received

the Richard Beatty Mellon Award, is the former president of the Mellon Institute.

Allan Kenneth Lazarus, currently working toward a Ph. D. at NYU, has been awarded the 1956-57 fellowship of Allied Chemical & Dye Corp.

Dale S. Davis, former professor of chemical engineering at Virginia Polytechnic Institute, has accepted a position at the University of Alabama as professor of engineering. In addition to teaching activities, Davis is probably the most prolific and tireless producer of nomographs in the field.

James A. Melchore, former group leader in the plastics and resins section of American Cyanamid's Stamford Research Laboratories, has been appointed senior technical sales representative for thermoplastic compounds.

John J. Reed has been named product manager of isocyanates by National Aniline Division; **M. S. Rhodes** holds a similar position for resin chemicals.

James H. Lum

Director of development of Monsanto's organic chemicals division, since 1953, James H. Lum has just been promoted to manager of research and development.

In his new position, Dr. Lum succeeds Howard K. Nason who has been appointed general manager of the company's research and engineering division.

Lum received his degree from Penn State in 1925 and a Ph. D., some years later, from Yale. He joined Thomas & Hochwalt Lab-

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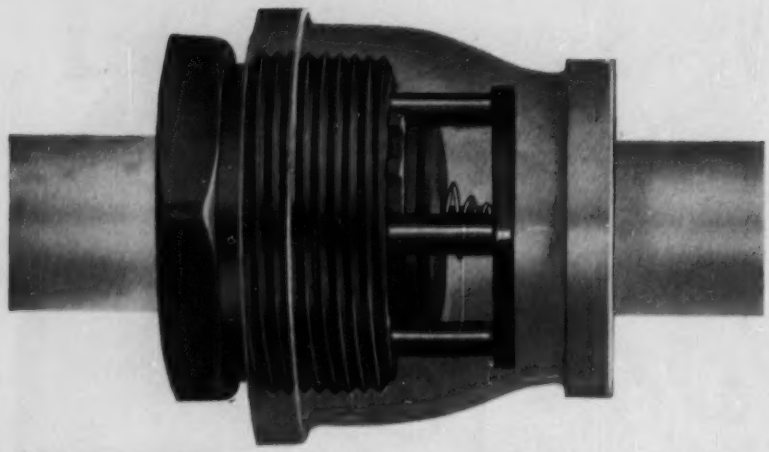

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By combining a Durabla Basic Check unit with any standard pipe fitting you can make a complete check valve (see right).

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Durabla valves cut costs, since all you buy are the working parts. What's more, they operate perfectly in any position. This eliminates stocking of separate vertical and horizontal-operating valves, and permits installation without changes in existing lines, or costly "positioning" in new installations.

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oratories, Dayton, Ohio, in 1933, and came to Monsanto when that facility was acquired as the central research department, in 1932.

Glenn W. Poorman

The election of Glenn W. Poorman as a vice president of Esso Standard Oil Co. has been announced by the firm.

Since January 1954, Poorman has been a director of Esso Standard and, since last Fall, he has served on the executive committee of the Esso board.

Poorman is a former general manager of the firm's supply department and a former director of the Plantation Pipe Line Co. He joined the company at the Baton Rouge (La.) refinery, in 1932, following graduation from Dartmouth and MIT.

He will continue as contact director for the firm's supply and transportation groups.

M. E. Pettegrew is the new vice president of Sylvania's tungsten-chemical and parts operations. **B. S. Ellefson** is now a vice president in charge of engineering and research.

Hermann C. Schutt has withdrawn as consultant to the Badger Process Div. of Stone & Webster Eng. Corp. and offers direct services to the petroleum and chemical industries on the production of reactive hydrocarbons.

Ralph F. Nickerson has been appointed a group leader of Shawinigan Resins Corp. to direct the firm's textile and paper coatings program.

Andrew F. Kritscher has been appointed manager of engi-

neering for Kaiser Aluminum & Chemical.

Kenneth A. Spencer, president of Spencer Chemical, was re-elected chairman of the board of trustees of Midwest Research Institute. **Harry Moreland,** president of Great Lakes Pipe Line, was named vice chairman.

John G. Seiler has been elected president of Tube Turns, division of Nat'l Cylinder Gas. He succeeds **George O. Boomer** who retired.

James H. McClain, chemical engineer with the US Bureau of Mines for 14 years, has resigned to become plant manager of zirconium production operation of Wah Chang Corp., Albany, Ore.

Robert R. Lichliter has been named superintendent of Virginia-Carolina Chemicals' plant at Fernald, O.; assistant superintendent is **J. W. Haubner.** Lichliter formerly spent 10 years in South America with Firestone Tire & Rubber Co.

Dudley Tower and **K. E. Kingman** are now directors of Union Oil Co. of California. They are vice presidents of production and manufacturing, respectively.

W. Ward Jackson

President elect of the Armed Forces Chemical Association, New York chapter—W. Ward Jackson—is a vice president of Commercial Solvents Corp.

Jackson, a chemical engineer, has been associated with the chemical industry in sales and production capacities since 1933.

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A leading manufacturer of wallboard experienced this problem, losing valuable profits in waste materials which escaped not only in hole drilling but during sizing, trimming, beveling and mortising operations. To combat this problem Ducon engineers recommended a special installation which provided efficient, automatic collection of waste materials and effected their return to the system for reprocessing.

Today, many of Ducon's maintenance-free Centrifugal Air Washers help transform waste into wallboard. Here is another instance in which companies achieve greater profits from production economy, aided by Ducon installations. Whatever your dust control problem, there is a Ducon unit designed to solve it.

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Use Riviclor for all in-plant piping of mild or strong corrosives at normal temperatures . . . for liquid lines where "sweating" or corrosive vapors are problems . . . for underground piping. Pipe, fittings, diaphragm valves from ½" to 2".

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Chromic 25%	S	Sodium Hydroxide 50%	S	Methyl Ethyl Ketone	U	Plating Solutions	S
Hydrochloric 38%	S	HALOGENS		Gasoline	S	Photographic Solutions	S
Hydrofluoric 50%	L	Sodium Chloride Sat.	S	Mineral Oil	S	KEY: S—Satisfactory	
Nitric 20%	S	Ferric Chloride	S	Animal Oil	S	L—Limited to certain applications	
Sulphuric 50%	S	Sodium Hypochlorite 5%	S	Vegetable Oil	S	U—Unsuitable	
Sulphuric 98%	S			Phenol 10%	S		
				Chlorine 5%	L		
				Alum	S		

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NAMES . . .

During World War II, he served as special assistant to the vice chairman of the War Production Board and as an aircraft consultant to several WPB bureaus.

The election took place at the association's annual spring meeting, at the Roosevelt Hotel in New York.

Victor Conquest

The Industrial Research Institute Medal for 1956 has been presented to Victor Conquest, vice president of Armour & Co.

The award has been awarded annually since 1945 to honor "outstanding accomplishment in leadership or in management of industrial research which contributes broadly to the development of industry or the public welfare."

When Conquest first began directing the firm's research activities in 1931, his department consisted of some 15 persons. Today, his technical staff numbers over 400 and, under his direction, has developed a variety of products including hormone and enzyme products and a wide line of chemicals from fats.

Max E. Bretschger has retired as division president of FMC's Becco Chemical Division to accept a position as senior technical advisor on peroxygen chemicals. The new president is **Frederick A. Gilbert**, former vice president and assistant division manager.

Robert S. Ingersoll has been elected president of Borg-Warner Corp. Formerly, he was administrative vice president.

R. L. Kunkel is the manager of the new Fort Worth, Tex.,

office of Barada & Page, Inc., agricultural and industrial chemicals.

John H. Nason has joined Colorado Oil & Gas Corp., Denver, and has been appointed vice president of its subsidiary, COG Minerals Corp., producer of uranium ore. Mason is the former general manager of Olin Mathieson's plant food division.

Edward A. O'Neal, Jr., former vice president and director of Monsanto Chemical Co., is the president elect of Chemstrand Corp. He replaces **Henry Bitler,** who is returning to American Viscose Corp.

Wm. B. Stephenson has been elected president of the Allen-Sherman Hoff Pump Co. succeeding **Homer E. Allen,** who will serve as chairman of the board of directors.

J. J. Chyle, director of Welding research, A. O. Smith Corp., Milwaukee, has been elected president of the American Welding Society.

William F. Gunning is been appointed assistant chief project engineer for Beckman Division, Beckman Instruments, Inc.

Herbert E. Silcox

Merck & Co. has appointed Herbert E. Silcox to the new position of technical director for the company's chemical division.

As technical director, Dr. Silcox will direct a coordinated scientific group for product and formulation development as the basis for increased technical service to customer industries.

Silcox joined the firm's re-

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NAMES . . .

search and development organization, in 1942, as a chemical engineer. Soon after, he became head of the chemical engineering development section. In 1947, he was appointed assistant director of development and, director of process development, in 1950.

Albert E. Forster

The president and chairman of the board of Hercules Powder Co., has been named recipient of the 1956 Memorial Award of the Chemical Market Research Assn. for his contributions to market research in the chemical industry.

The award was presented at a dinner meeting of Association members May 23.

Forster was elected chairman of the board of Hercules in March of this year. He has been president of the firm since early 1953 and a director since 1940.

Charles W. Kleiderer has been appointed a vice president and a member of the board of directors of Penn-Plastics Corp. **William F. Kelly** has joined the firm's engineering staff.

Thomas E. Deger has been named director of organic research for Pennsalt. He transferred to the firm's Whitemarsh Research Labs in 1952 when Sharples Chemicals became a division of Pennsalt.

Irving Roberts is now director of planning for Reynolds Metals Co., Louisville, Ky. For the past five years, he has served the firm as a consulting engineer.

James H. Dempster is now general manager of Republic Flow

Meters Canada Ltd. Formerly, he had specialized in plant development engineering in the fats and oils field.

M. P. Love has been promoted from manager of Shell Oil's Houston refinery to manufacturing vice president of the firm, with headquarters in New York.

OBITUARIES

G. Edwin White—Chairman of the department of chemical engineering at City College, died May 2 of a cerebral hemorrhage after a brief illness. He was 52 years old.

Professor white earned his own B. S. degree at City at the age of 19. He graduated summa cum laude with a straight "A" average.

Following graduation, he began teaching as a fellow in the School's chemistry department. He earned his M. A. at Columbia in 1927 and, ten years later, his Ph. D.

In total, Professor White taught thirty three years at City; and became department chairman in 1947.

He was a frequent contributor of chemical engineering articles to various journals.

Eugene C. Crittenden, 75, retired associate director of the National Bureau of Standards and U. S. representative on the International Committee on Weights and Measures from 1946-54, died March 28.

John H. Gibbon, Sr., 84, professor emeritus of surgery at Jefferson Medical College, died March 13.

Arthur A. Blanchard, former professor of chemistry at Massachusetts Institute of Technology, died March 25.

Victor Zahn, 69, retired chemist for Shell Development Co., Emeryville, Calif., died April 18. A native of Germany, he came to this country in 1929 and joined Shell the same year. He retired in 1949 as assistant head of the analytical department.

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237

"Here's another exclusive feature on Pritchard Towers, Joe!"

"You mean the twist on the fan blade?"

"Yes. It's part of the patented design of Pritchard's fan. Incidentally, this fan was designed specifically for cooling tower service. Also notice the use of monel metal in the blades."

"Just what is different about its design that makes the Pritchard tower more efficient?"

"Each blade is pitched in such a way as to pump as much air at the hub as at the tip of the fan blade. Even the hub design is unique."

"Now, I understand. In other words the hub and blade design permits back-flow near the hub and increases efficiency."

"Right. This means the fan operates on less horsepower—a big savings to you."

"I sure like the way the blades are fastened to the hub."

"That's another interesting feature, Joe. It's a real simple and rugged connection that enables us to change the pitch of the blades quickly and easily."

"Those Pritchard designers and engineers think of everything! That's why I always think of Pritchard, first!"

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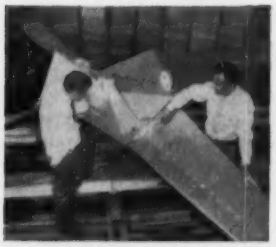

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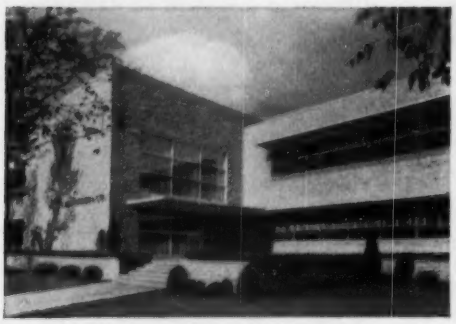
Complete staff of Pritchard engineers are available to you!



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REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

Letters: Pro & Con

C. H. CHILTON

Pro: Physical Equilibria

Sir:

It is with greatest interest and appreciation that we have followed Dr. Corrigan's series of articles in *Chemical Engineering* (CE Refresher).

We are especially looking forward to the series on physical equilibria and separation processes which you mentioned were forthcoming.

G. VAN DEN BOGAERDE
National Petro-Chemicals Corp.
Tuscola, Ill.

Which Reduction Catalyst?

Sir:

In your last inventory issue (p. 38) your review of New Processes and Technology states that the Sinnova plant in Toulouse, France, uses a nickel-chrome catalyst for the reduction of fatty acids to fatty alcohols.

General practice is to employ Adkin (copper-chrome) catalysts. We find in the periodical, "Oleagineux" (Nov. 1954, p. 802), a description of the Sinnova plant which states that Adkin catalyst is employed.

In view of this discrepancy we wonder whether an error has occurred in your paper or whether you have reliable information on the use of nickel for this purpose.

DR. ING. BAYER
Lurgi Gesellschaft fur Warmetechnik m.b.H.
Frankfurt am Main, Germany

▶ *We asked Sinnova's U. S. representative to clarify this question for us; see next letter.*—ED.

This Catalyst Is Cheaper

Sir:

Nickel-chrome, copper-chrome and similar materials have been investigated by many organizations, including Sinnova, for use as high-pressure fat hydrogenation catalysts. Copper-chrome has probably been used by Sinnova for a longer time than any other catalyst. It is not being used now, however.

Due to the rather high cost of the above-mentioned metals, the Sinnova Co. has carried on a continuous program of research to develop a catalyst of satisfactory performance at lower cost per pound of product.

These efforts have met with considerable success. I regret that I am not at liberty to disclose the nature of the catalyst now being used; I can state only that within the past year the cost of catalyst has been reduced to about one-third of the previous value.

F. W. DITTMAN
Rust Engineering Co.
Pittsburgh, Pa.

▶ *See the next letter for news of another, closely related development.*—ED.

This Catalyst Is Selective

Sir:

In your January 1956 Annual Review, you published (p. 187) a piece headed, "Choose Your Route to Fatty Alcohols." We thank you very much for having cited the new SBA process of catalytic hydrogenation for the preparation of fatty alcohols.

However, you mention that hydrogenation processes tend to saturate the double bonds of unsaturated fatty acids. In this connection, we take the liberty to catch your eyes on the fact that we have also perfected a process for the preparation of unsaturated fatty alcohols by hydrogenating corresponding free unsaturated fatty acids or their derivatives, such as their esters of mono- or polyvalent alcohols.

This new process is based on the use of a selective hydrogenation catalyst which orients the hydrogenation selectively to a complete reduction of the carboxyl group into the hydroxyl radical, while keeping up substantially all the eventual double bonds of starting materials.

This new process is covered by Belgian Patent 540,285, as well as by many other copending applications in several countries, including U.S.A.

We would like to clear up that

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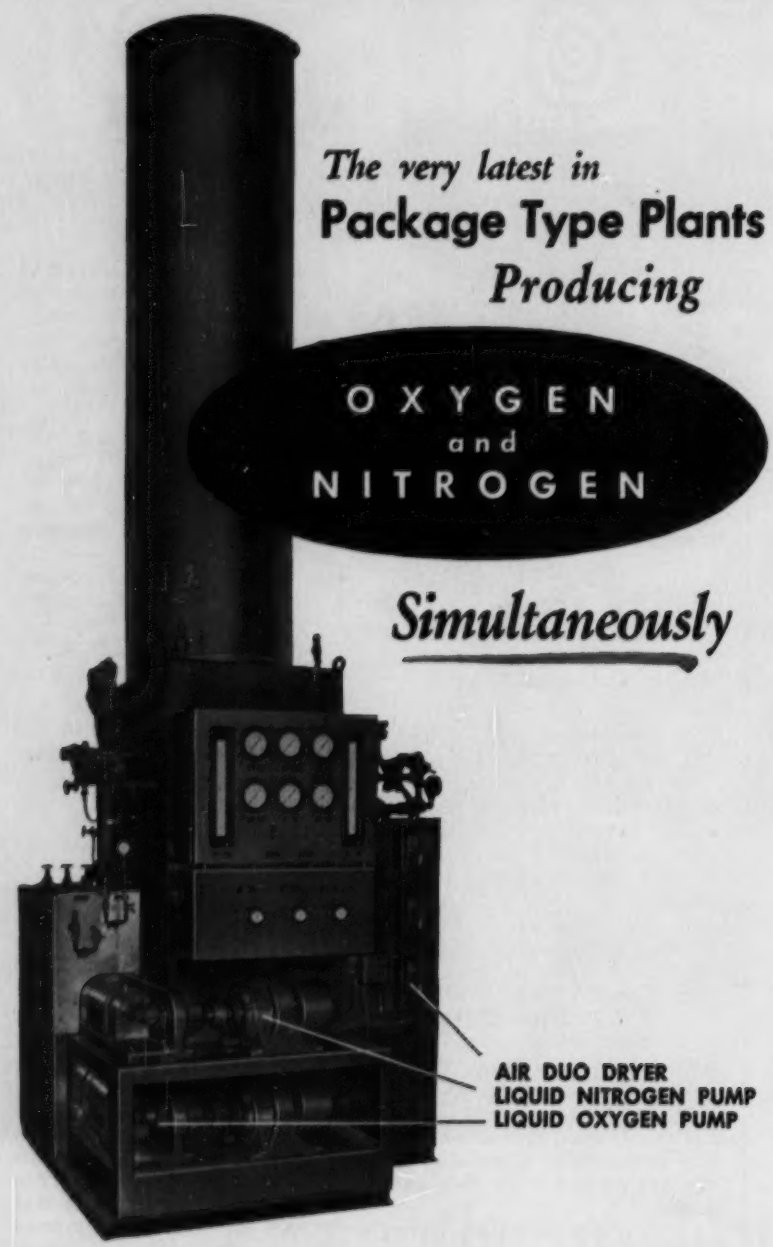

With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously *increases* production 60% over the production of Oxygen alone, *plus* a corresponding reduction in the *cost* of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

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O'FALLON, 7 ILLINOIS

the SBA abbreviation in the expression, "the SBA process," refers to our company's name, not your government's Small Business Administration.

E. HANS
F. BRACONIER
Societe Belge de l'Azote et des Produits Chimiques du Marly
Liege, Belgium

Detergent Alkylate in U.K.

Sir:

In your April 1956 issue (p. 124) you referred to the coming on stream of a new detergent alkylate plant in Scotland.

You continued, "Only previously existing U.K. dodecyl benzene plant, that of Imperial Chemical Industries, did not meet the (British) nation's total requirements."

For I.C.I you should have substituted Monsanto Chemicals Ltd. We have been until recently the only, and still are a major, source of alkyl benzene both for British and overseas detergent industries.

W. D. GARNER
Monsanto Chemicals Ltd.
London, England

Con: Dual Nomenclature—I

Sir:

It seems to me that there is a small error in the article, "Shortcuts for Transient Heat Flow" (Feb. 1956, pp. 183-6). The authors say that Solution (b) does not meet the Fowler rule while Solutions (d) and (e) do. However, the values in their chart show that the unmodified Schmidt method, Solution (b), does meet the requirement of Fowler's rule, as given by their Eq. (9), and Solutions (d) and (e) do not.

However, these comparison values appear to be invalid anyway. The symbol N is defined in the nomenclature as the number of sections the body is divided into. This would be 4 for Solutions (b) and (d) instead of 1, and 8 for Solution (e) instead of 0.5. I presume that this is the same N used in Fowler's rule. It then follows that all three solutions meet Fowler's rule for convergence. In fact, the "crude" Schmidt method of Solution (b)

meets Fowler's rule if only one section was taken in the body.

The values of N used by the authors in their summary chart are shown by the text on p. 186 to be derived from

$$N = h\Delta x/k$$

But according to the authors' Eq. (8),

$$N = (t^* - t_s)/(t_h - t_s)$$

which should have nothing to do with Fowler's rule for convergence.

STANLEY WONG
Los Angeles, Calif.

▶ *Reader Wong's difficulties are echoed—and explained—in the following letter from another reader.* —ED.

Con: Dual Nomenclature—II

Sir:

In the article, "Shortcuts for Transient Heat Flow" (Feb. 1956, pp. 183-6), reference is made to C. M. Fowler's rules for solutions of transient conduction. In Eq. (9) you use the sign $\leq$ (equal to or less than). According to Fowler's original paper, this sign should be $\geq$ (greater than or equal to).

In the table of nomenclature, the term N is defined as "number of sections body is divided into." This definition holds true for the first part of the discussion only. When used in Fowler's rule,

$$N = h\Delta x/k$$

as shown in Fig. 4.

WALTER R. SUPINA
Pennsylvania State University
University Park, Pa.

▶ *Messrs. Wong's and Supina's observations were anticipated and confirmed in a letter we received from Co-Author Granet shortly after the article appeared.*—ED.

Con: Dual Nomenclature—III

Sir:

I find that there are some corrections that have to be made in the article Bob Gould and I wrote. These are:

- Last term in last line of Fig. 4 has the wrong sign. It should read $M > 2N + 2$.
- In Eq. (9) the inequality is reversed. It should read $M - 2 \geq (N^2 + 1)^{0.5} - 1$.
- The symbol N appears to have been used in a dual sense.

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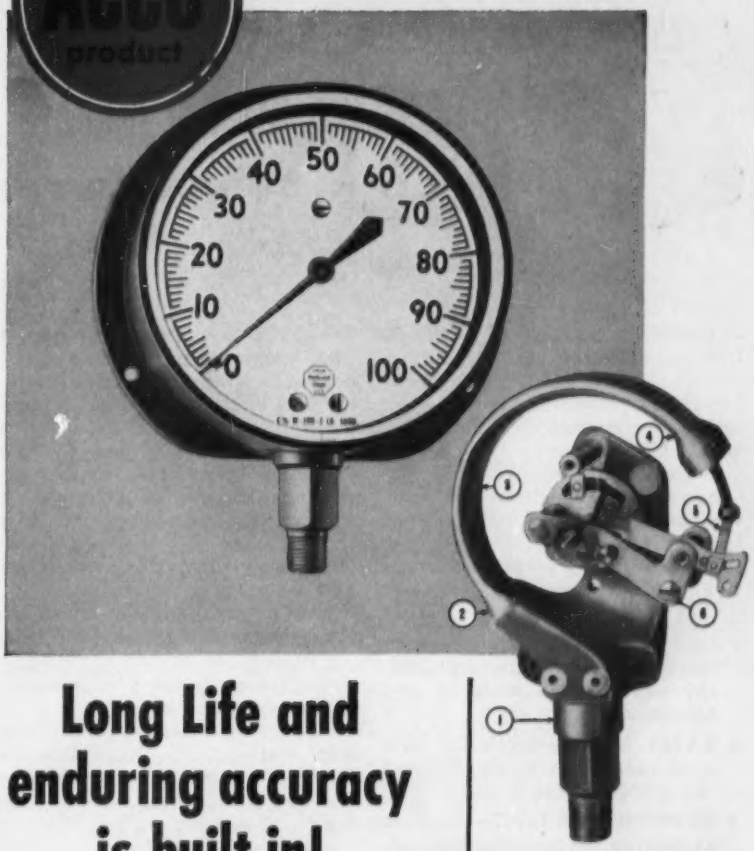

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A unique installation of National-U.S. large evaporative cascade type coolers is solving the cooling problem for The Eagle-Picher Company in the manufacture of sulfuric acid at Galena, Kansas.

Each cooling unit combines the water cooling principles of a conventional wood tower with the heat exchanger principle of National-U.S. cast iron cooling sections through which the acid flows.

The advantages are three-fold:

1. **SAVES WATER in an area where water is scarce—makeup quantity equal to evaporation and blowdown losses only.**
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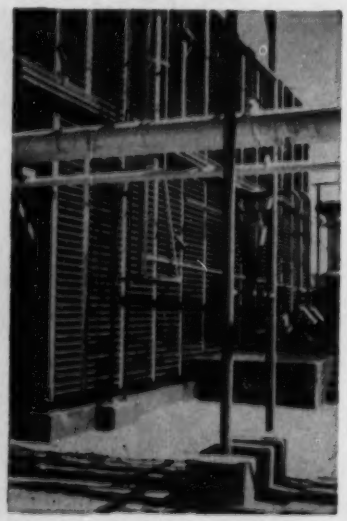
The entire cooling area is blanketed with spray from a series of jet nozzles forming a checkerboard umbrella of water over the coolers and pit. Water circulation quantity is two-and-a-half times that of a conventional installation. A proportionate cooling effect is exerted on the heated water from the heat transfer surface, plus considerable evaporative effect from warm water on the surface of the sections.

Over two years of operating experience has proved the efficiency and the triple advantages of this installation of coolers designed by National-U.S. engineers.

For full information, get in touch with National-U.S. Heat Transfer Division, whose engineers will also be glad to discuss your particular cooling problems with you.

Exterior view of the coolers at Galena, Kansas sulfuric acid plant of The Eagle-Picher Company. Note the resemblance to a conventional cooling tower. Circulating water pumps can be seen at the left.

Looking down on water sprays in operation at the evaporative cooler. (Installation was made by Leonard Construction Co., Chicago.)



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HEAT TRANSFER DIVISION HEADQUARTERS
342 Madison Avenue, New York 17, New York

PRO AND CON . . .

Estimated Costs of Acid

Pickling process	Conventional
Pickling capacity	A
Normal acid use, tons/yr. of 78% H_2SO_4	10,000
Free acid in effluent	5.5%
Acid recovered, tons/yr. of 100% H_2SO_4*	6,470
Capital investment, $1,000	600
Fixed charges, $/day†	317
Utilities	286
Raw materials	17
Labor	88
Total recovery costs, $/day	708
Iron oxide credit, $/day	72
Net recovery costs, $/day	636
Net recovery costs, $/ton 100% H_2SO_4	35.40

*Based on 15% acid loss during pickling and 98% recovery on acid charged to recovery plant.

In Fig. 4 it is used to denote $N = h\Delta x/k$, while in the nomenclature (and in the text) N is used to denote the number of sections the body is divided into. These should have been distinguished by use of different symbols.

IRVING GRANET
Oak Ridge School of Reactor Technology
Oak Ridge, Tenn.

Pro: Correct Acid Costs

Sir:

Your interesting article, "HCl Regenerates Waste Pickle Liquor" (Feb. 1956, p. 132), describes the Ruthner process and gives the cost of recovered H_2SO_4 for a high-acid pickling line (about 25,000 to 50,000 tons/yr. recovered acid) as about $12 to $14 per ton. I would appreciate clarification of the cost table in which these figures appear, since I am probably missing a point.

From your figures I computed a lower limit of about 36½ years as a period of writeoff. It is inconceivable to me that this period could have been intended as a period of writeoff for H_2SO_4 and HCl acid-handling facilities

Recovery by Ruthner Process

High-Acid A	Conventional 2A	High-Acid 2A
10,000	20,000	20,000
25%	5.5%	25%
15,050	12,940	30,100
630	1,050	1,100
333	553	580
223	572	446
17	33	33
88	127	127
661	1,285	1,186
72	145	145
589	1,140	1,041
14.05	31.80	12.50

†Based on annual charges against investment of 10% for amortization, 4% for maintenance, 2% for insurance and taxes, 3% for interest, 360 days/yr.

with many moving parts, evaporator, roaster, columns, etc. A period of less than 10 years would be more in line, but would increase the cost of the recovered sulfuric acid in all cases presented well beyond the base figure of $20 per ton given for new sulfuric acid.

The figures given as weekly costs would imply a fraction of one operator operating all these facilities on a 24-hr. basis. Also, dividing the sum of the weekly costs by weekly product yields 0.1 of the unit cost of acid given in the table.

I suspect that the whole table got scrambled up somewhere, unless I am scrambled up myself.

JOHN SHACTER
Carbide & Carbon Chemicals Co.
New York, N. Y.

▶ *Reader Shacter is right; the whole table got scrambled up when we made the decimal-point error referred to in the third paragraph above and compounded the confusion by failing to distinguish between 60° Be. acid and 100% acid. With the help of Blaw-Knox engineers, we have prepared a corrected and expanded table of acid recovery costs which should be substituted for the table published on p. 134 of the February issue. Basis*

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Berlin, New Hampshire

General Sales Office: 150 Causeway Street, Boston 14, Mass.

for these corrections is explained below.—ED.

Acid Costs Explained

Sir:

In the written material we handed you during our discussion of the Ruthner process, it was pointed out that the capacity figures in the cost table referred to tons of 60° Be. acid normally consumed by a steel plant.

In order to obtain tons of 100% acid recovered per year, it is necessary to correct for the 60° Be. figure as well as subtract a 15% rinse-water loss normally encountered in pickling operations. On this basis, a plant that would normally consume 10,000 tons of 60° Be. acid would recover 6,470 tons/yr. of 100% acid from the recovery process.

It was deemed advisable to state the capacity of the plant in this manner, because in many steel plants the only consumption figure available is the tons of acid purchased, readily obtainable from their accounting records. In this manner the steel plant operator can conveniently compare the size of his pickling operation with those listed in the table.

Admittedly, when operating at 25% free acid the acid consumption for a given amount of steel pickling will be increased. However, as pointed out above, the capacity figures are meant to refer to the size of the pickling installation and were carried through in the discussion of high-acid pickling. This increased consumption is indicated by the figures in the new table for tons of acid recovered.

M. M. RAMER
Blaw-Knox Co.
Pittsburgh, Pa.

Pro: Better Treatment—I

Sir:

I read your article, "Here's How You Could Be Treated Better," by Herbert R. Northrup, in your April issue (p. 214).

I wish to compliment your editorial policy in printing this type of article. This particular article, I feel, is very good and is the type of information which must be presented to manage-

ments throughout the country in order to raise the status of the engineer in industry. It is my personal feeling that only through raising the engineering status will we attract more high-caliber young men into the engineering profession.

G. H. SILVER
Titeflex, Inc.
Springfield, Mass.

▶ *Another reader expresses a different point of view in the following letter.*—ED.

Pro: Better Treatment—II

Sir:

DISTURBING is the word for Mr. Northrup's article, "You Could Be Treated Better," in your April 1956 issue (p. 214). I disagree particularly with his statements regarding the setting of salaries.

The article includes three points on establishing engineers' salaries. The first two say, in effect, "Pay a price competitive for area and industry." The third point says, "Keep salary and prerequisites of professionals well above those of rank-and-file workers." These points are very smoothly said, but are self-contradictory.

In most of the industries that I know (oil, chemicals and steel), engineers' salaries in the first 5 to 10 years remain below those of the rank-and-file, if by rank-and-file one means those employees who are actually getting the physical job of manufacturing done. This situation is no better and is no worse than it was 20 or 30 years ago. It may in itself be bad, or it may be good, but it is a tradition which must be changed if all three points of Mr. Northrup's article are to be fulfilled by an employer.

Smooth statements like these (along with high-powered recruiting—aptly criticized by Mr. Northrup—and a great deal of talk of shortage of engineers) are creating unrest among professional people. I trust that your publication will carry other articles which will assist engineers to arrive at a judiciously chosen course of action.

JOSEPH BYRNE
Union Oil Co. of California
Concord, Calif.

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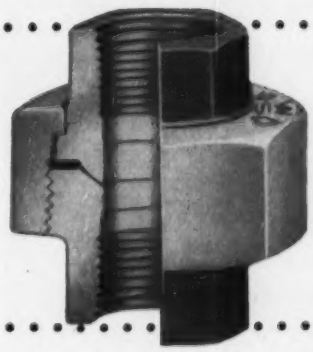

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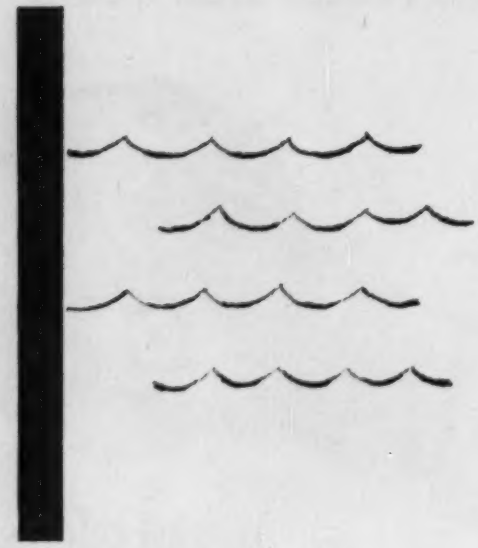

In contact with many highly corrosive chemicals, including chromic, sulfuric, sulfurous and phosphoric acids, lead reacts instantly to form an adherent and insoluble surface film. No matter how often this skin is damaged, it re-forms automatically to give full protection against corrosion. Lead alone among metals and synthetic materials, has this inherent ability to heal itself immediately.

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Meet Your

Russell G. Dressler

HOW THIN ARE UNITED STATES ENERGY RESOURCES? PAGE 173

Russell G. Dressler probably is more acutely aware of U. S. energy resources than most any other contemporary chemical engineering author. In a very personal manner he has wrestled with the problem of dwindling energy sources which he surveys in "How Thin Are U. S. Energy Resources?", p. 173.

During the period 1946-1953 as Chief, Gas Synthesis Demonstration Plant, Louisiana, Mo., Dr. Dressler was in charge of the Bureau of Mines large-scale experimental program to develop synthetic liquid fuels. Various aspects of this program dealt with coal gasification, gas purification, oxygen production and Fischer-Tropsch processes.

Before joining the Bureau of Mines pioneering effort, Dr. Dressler gained valuable experience with another prime energy source—petroleum. From 1944 to 1946 he supervised research and development programs in petrochemicals and petroleum treating for California Research Corp.

During World War II, the Chemical Corps, U. S. Army employed Dr. Dressler's talents in the role of Senior Chemical Engineer-at-Large. He served as coordinator of chemical plant design; representative in charge of technical phases of design, construction and startup of an organic chemicals plant; and Senior Technologist and Advisor for layout, startup and operation

Authors...

of 10 chemical production plants.

Since leaving the Bureau of Mines, Dr. Dressler has been Technical Assistant to the President, Atlas Powder Co. conducting process and economic studies, company diversification planning and surveys. Also, he has been a chemical engineering consultant working under contracts for Hercules Powder Co. and Hydrocarbon Research, Inc.

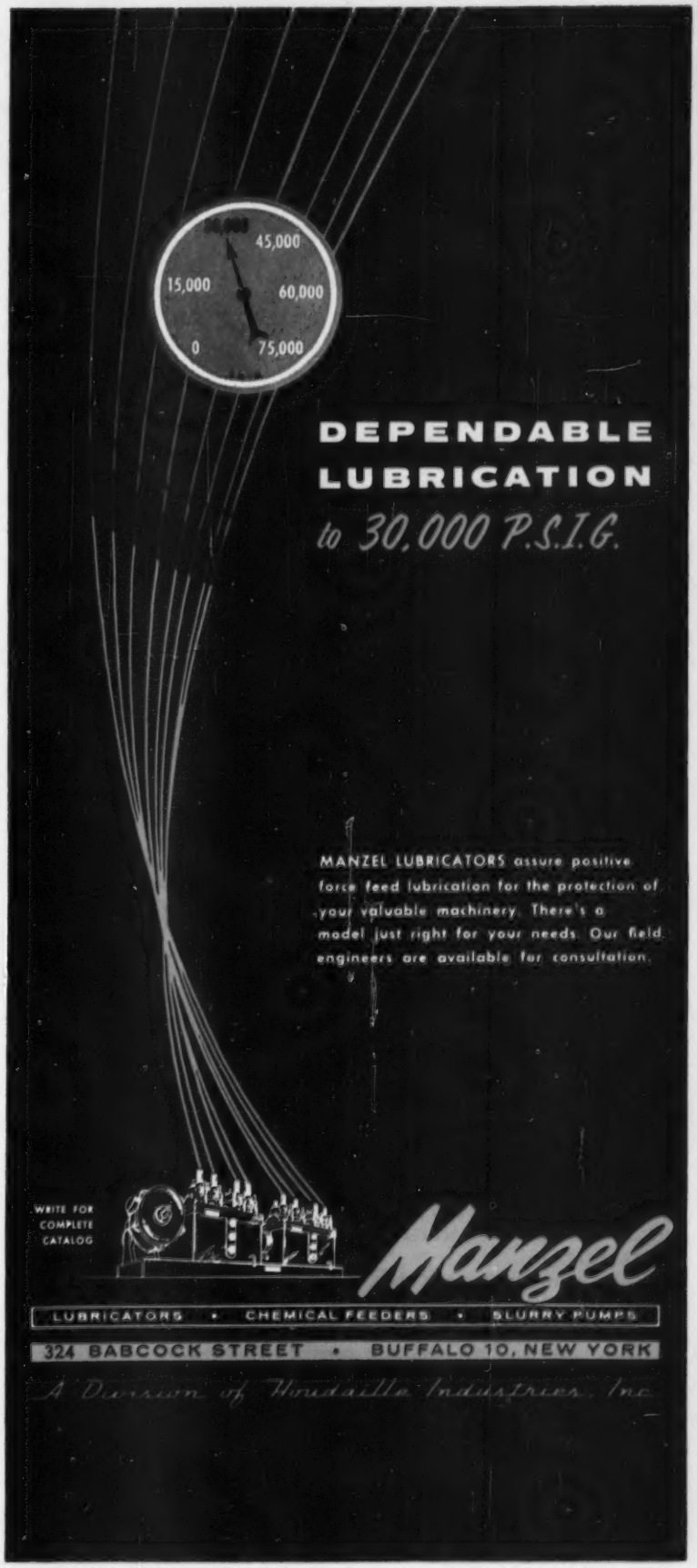
At the present time, Dr. Dressler is Manager of Chemical Engineering Research, Southwest Research Institute, San Antonio, Tex.

Robert R. Cruse

HOW THIN ARE UNITED STATES ENERGY RESOURCES? PAGE 173

Robert R. Cruse, coauthor with Dr. Dressler, contributes from a background gained working directly with U. S. mineral resources. At the Southwest Experiment Station of the Bureau of Mines, Tucson, Ariz., he worked as an extractive metallurgist on the application of leaching and flotation techniques to the beneficiation of copper and manganese ores. Prior to that he assayed ores and beneficiated ore products, developed new assaying methods.

Mr. Cruse's collegiate training was Antioch College, Yellow Springs, Ohio. Under the Antioch cooperative plan with industry he worked at the Eastern States Milling Co., Buffalo, N. Y. and at the C. F. Kettering Foundation for the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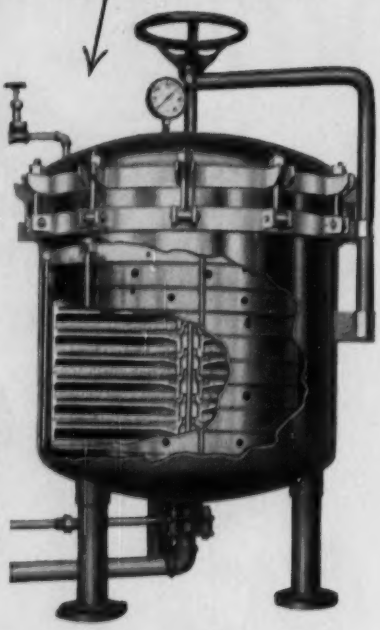

Versatile adaptability make this filter the logical choice of filtration engineers for difficult filtering problems.

Every filtering job usually presents an individual problem involving a combination of various kinds of screens, papers and filter aid. Frequently temperatures are encountered that call for a brine or steam jacketed tank. Linings; plastic or rubber may be needed, with tank and plate metals to fit the product such as mild steel, monel, nickel, stainless steel, bronze or Hastelloy. Constructed to meet ASME specifications when required.

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Write Eric Anderson

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AUTHORS . . .

Study of Chlorophyll and Photosynthesis, Yellow Springs, Ohio.

Following graduation with a BS in chemistry, Mr. Cruse was a Research Engineer at Battelle Memorial Institute, Columbus, Ohio. He worked on applied organic chemistry in the fields of bright electroplating, rubber and auxiliary chemicals and pharmaceutical intermediates.

Currently, Mr. Cruse is Associate Industrial Chemist, Dept. of Chemistry and Chemical Engineering, Southwest Research Institute, San Antonio, Tex.

Wallace R. Gambill

WHY NOT USE THE DRAG COEFFICIENT? PAGE 177

Wallace R. Gambill started his consulting career at a rather early age. After graduation from Georgia Tech in 1952 as a BS in chemical engineering, he joined the engineering division of Carbide & Carbon Chemicals Co. at S. Charleston, W. Va. Working in Charlie Gilmour's group he helped in the design of heat exchange equipment, jet mixers, entrainment separators, distillation and extraction columns.

In connection with this design work Wallace Gambill started collecting information on methods for estimating physical and engineering properties. This collection became a valued reference volume and copies were made up for circulation within the Carbide & Carbon engineering organization. By preparing this manual and keeping it up to date, Gambill became an unofficial consultant to project engineering groups at Carbide. A consulting chemical engineer at the age of 25!

Last December we published Gambill's article describing how to estimate mass-transfer factors (*Chem. Eng.*, Dec. 1955, p. 207). This month our author points up the usefulness of the drag coefficient in chemical engineering calculations.

Recently Wallace Gambill was transferred to a new position. He is now with the reactor experimental engineering division, Oak Ridge National Laboratory, operated by Union Carbide Nuclear Co. at Oak Ridge, Tenn.

Daniel Kist

SIMPLIFIED COMBUSTION CALCULATIONS. PAGE 179

Daniel Kist's combustion know-how has been rigorously developed during the past three years, during which time he has been actively engaged in the design and development of both process and power-recovery gas turbines—including their combustion chambers and control systems.

Mr. Kist is employed as a development engineer in the Process Section of the Elliot Co.'s Development Dept. at Jeannette, Pa. A mechanical engineer, he received his BS from Penn State in 1953.

Before entering Penn State in 1949, Mr. Kist acquired a wide range of industrial experience, having been employed since 1935 in various capacities at the Altoona Works of the Pennsylvania Railroad and in the Pennsylvania Railroad Test Dept. as well. During most of his college years, he was employed as a part-time assistant in the Penn State Engineering Experiment Station.

Mr. Kist is married and is the father of four children, two boys

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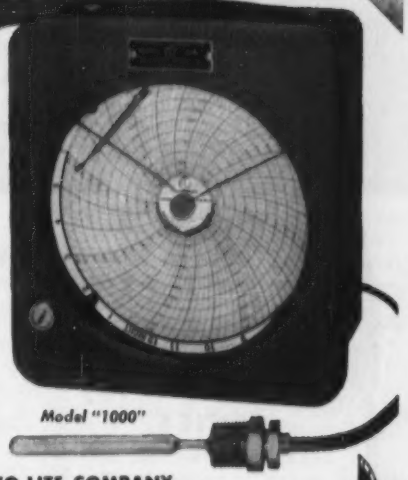

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AUTHORS . . .

and two girls. An enthusiastic home craftsman, he is presently engaged in the restoration of an old house which he plans to make his home.

Mr. Kist is active as a junior member of the ASME. He is also active in several veterans and service organizations in his community.

The Elliot Co. with which Mr. Kist is associated are manufacturers of heavy equipment such as steam and gas turbines, electric generators and motors, blowers and compressors, turbochargers for diesel engines, condensers, steam jet ejectors, deaerating feedwater heaters, strainers and tube cleaners.

Robert Frumerman

SIMPLIFIED COMBUSTION CALCULATIONS. PAGE 179

Robert Frumerman is Manager of the Process Section for Development Engineering, Elliot Co., Jeannette, Pa. In this capacity, he is concerned primarily with process application and design.

Mr. Frumerman was introduced to the readers of *Chemical Engineering* last month. His article on steam jet ejectors is part of the 64-p. report "Handling of Compressible Fluids." Therein he drew from his extensive experience in vacuum technology to describe ranges of applications for ejectors and pressures used, how they operate, differences between condensing and non-condensing ejectors, how to figure steam consumption for a given ejector load over a given pressure range, and ejector costs.

A registered chemical engineer (Pennsylvania), Mr. Frumerman received his BS from the Uni-

versity of Pittsburgh in 1947, and later obtained an MS from Carnegie Tech.

His interest in combustion stems from applications to gas turbine cycles. Combustion, however, represents only one phase of his activity, as he is primarily concerned with application of new combinations of power equipment for the process industries. Other fields of interest include heat transfer, fluid flow, heat exchangers, pumps, controls.

Mr. Frumerman was previously affiliated with the Blaw-Knox Co. as a process engineer, and before that with Elliot Co. engineering all phases of steam ejectors. He is a member of the AIChE, and is active on various committees of the institute.

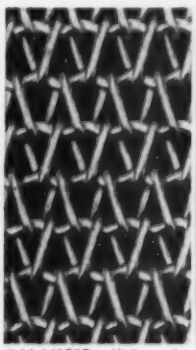
Ryle L. Miller, Jr.

ORGANIZING FOR PLANT DESIGN. PAGE 185

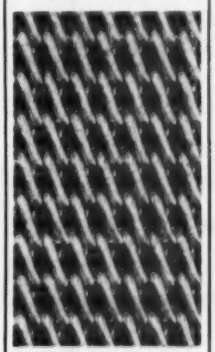
Ryle L. Miller, Jr., is a senior engineer with the Refinery Engineering Division of Bechtel Corp., in the company's San Francisco office. His work is primarily in project engineering, but his previous experience with several different concerns among the engineering contractors, and in several different capacities including process engineer and "job" engineer, have given him an excellent vantage point for writing his article.

Miller received his BS in chemical engineering at Pennsylvania State University, State College, Pa., in 1947. After 1½ years with Bethlehem Steel, he joined the process department of the Lummus Co. as a process engineer. With Lummus for over five years, he worked both in New York and abroad, the latter in Paris and at The Hague.

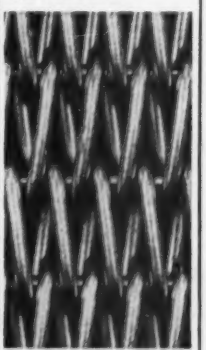
How to select WOVEN WIRE CONVEYOR BELTS for Continuous CHEMICAL PROCESSING



BALANCED—High tensile strength, low ultimate cost belting for operation up to 1300° F. Resists distortion. Designed for straight travel.



DUPLEX—Compact structure of great density provides high tensile strength. Close mesh provides smooth surface for carrying small-size particles, as well as sheet and slab materials that might be marked by more open weaves.



GRATEX—Close spirals retain the advantages of Balanced weave, while adding strength. For cold, medium and some high temperature applications.

As you know, woven wire conveyor belts are widely used for combining movement with processing and packaging of slab, sheet, pelletized and powdered materials. The advantages offered by open mesh construction for both wet and dry processing have resulted in steadily increasing demand for these belts in the chemical and plastic industries. Washing, forming, draining, heating, drying and bagging operations proceed uninterrupted, increasing production efficiency and product uniformity, decreasing waste.

However, there is no single type of belt construction suitable for all chemical and allied processing. Some must withstand constant operation at moderately high temperatures; some must provide a relatively smooth, non-marking surface for handling soft sheet or slab materials; some require open mesh for rapid drainage of process solutions or spillage from bagging machines; others need a close mesh to handle materials of small particle size. That's why Cambridge has nine basic weaves available in any metal or alloy. The three shown here are the most widely used in chemical and allied fields.

Two others, the CORDUROY and DOUBLE-BALANCED, are also employed where exceptionally smooth surface and close mesh are prime factors.

There are several factors that generally influence selection of weave, mesh size and metal or alloy from which the belt will be woven. Among them are: form and particle-size of materials to be handled; temperatures to which belt will be subjected; presence of wet or corrosive conditions. Even after these have been decided, overall belt construction must be designed to meet individual requirements—type of drive, selvage, support and special surface attachments must be selected.

You can see, then, that designing for continuous chemical and plastic processing with woven wire conveyor belts is not a simple "nuts and bolts" job. Ramifications build up rapidly to demand the service of a specialist. That's why Cambridge maintains a staff of competent Field Engineers to help you select the Woven Wire Conveyor Belt to make your installation most efficient. You can rely on the experience of these engineers to specify just the right belt for you. In addition, they are thoroughly familiar with basic conveyor design. For the name of your nearest Cambridge Field Engineer, look under "Belting, Mechanical" in your classified telephone book. Or, write direct. Also ask for Special Report on a typical installation, "9 WAYS to Speed Production in RUBBER PROCESSING" and your copy of 130-page Reference Manual of specifications and design information.

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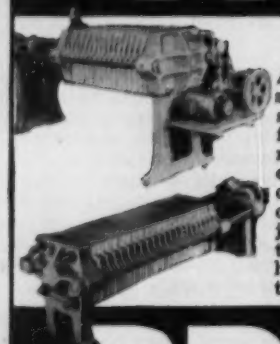

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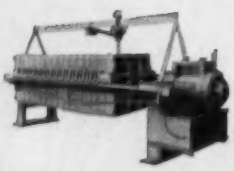

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AUTHORS . . .

After returning to the States he went to work for M. W. Kellogg Co. as a "job" engineer. Just a year ago he joined Bechtel. Present address (as of last month) is Lummus, Paris, France.

Although he started in design work, Miller's principal experience and interests lie in project coordination. He has worked on process and engineering design on Hypersorbers, natural gas processing units, ethylene plants, chemical plants of various types, cat crackers, alkylation units, treating plants and crude oil topping units. One of his outstanding assignments was as a process engineer on a unique phenol acetone plant in Europe.

He is a registered professional chemical engineer in California, is the proud owner of an Austin Healy sports car and says that when time permits he hopes to indulge and develop his "admiration" for good wine, exotic foods, and good art—preferably Renaissance.

Chesman A. Lee

TRENDS IN FATTY ACID DISTILLATION. PAGE 189

Chesman Lee has written a number of articles for Chemical Engineering in addition to "Trends in Fatty Acid Distillation" on p. 189 of this issue.

In all of them, he demonstrates his remarkable ability to cut away the window dressing and get to basics on whatever problem he's concerning himself with. His mind is as sharp as the needle-pointed pencils he keeps in a glass at the top of his drawing board.

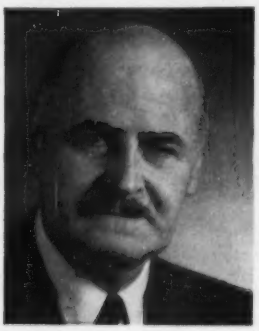
Besides making major improvements in fatty acid distillation and in the handling of

associated products, Mr. Lee has distinguished himself with his investigations relating to long-pitch chain pulsations and pressures in hoppers.

A plant man as well, Mr. Lee at one time kept a wheezing, clanking, out-dated mess of machinery turning out top-grade fertilizer—and helped select the new equipment that replaced it.

The informal phases of his education include a good deal of home study in such subjects as calculus, strength of materials, chemical engineering and soil mechanics—and training as a machinist and as a millwright.

Chemical Engineering's most colorful author recently went to work for the U. S. Steel Corp., South Works. After work, he returns to his home at 1412 Leonard Place, Evanston, Ill., to play bridge (fanatically), read suspense novels, or participate in community activities.



H. E. Serner

GET THE POWER REQUIRED FOR MIXING. PAGE 195

H. E. Serner, a frequent contributor to *Chemical Engineering*, is president of the H. E. Serner Co. of Oakland, N. J.

A graduate of the Technical University of Vienna, with a mechanical engineering degree, Mr. Serner has extensive experience in the design and construction of chemical process equipment.

He has been connected with Linde Air Products in general construction and design work, then with Alco Products where he worked on design of boilers, furnaces, distillation, fractionation, extraction and heat exchange equipment.

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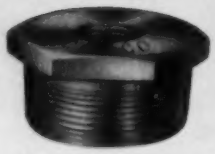

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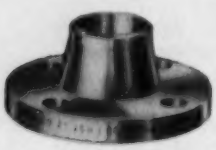

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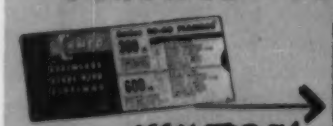

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of E. B. Badger & Sons as a project engineer. While there he was put in complete charge of the design and construction of the first large-scale plant for penicillin production. This was for Commercial Solvents.

In 1944 he became director of engineering for the H. K. Porter Co. of Pittsburgh, Pa. Confronted by a lack of good technical data, he prepared a company manual on fluid agitation and mixing.

Robert L. Callard

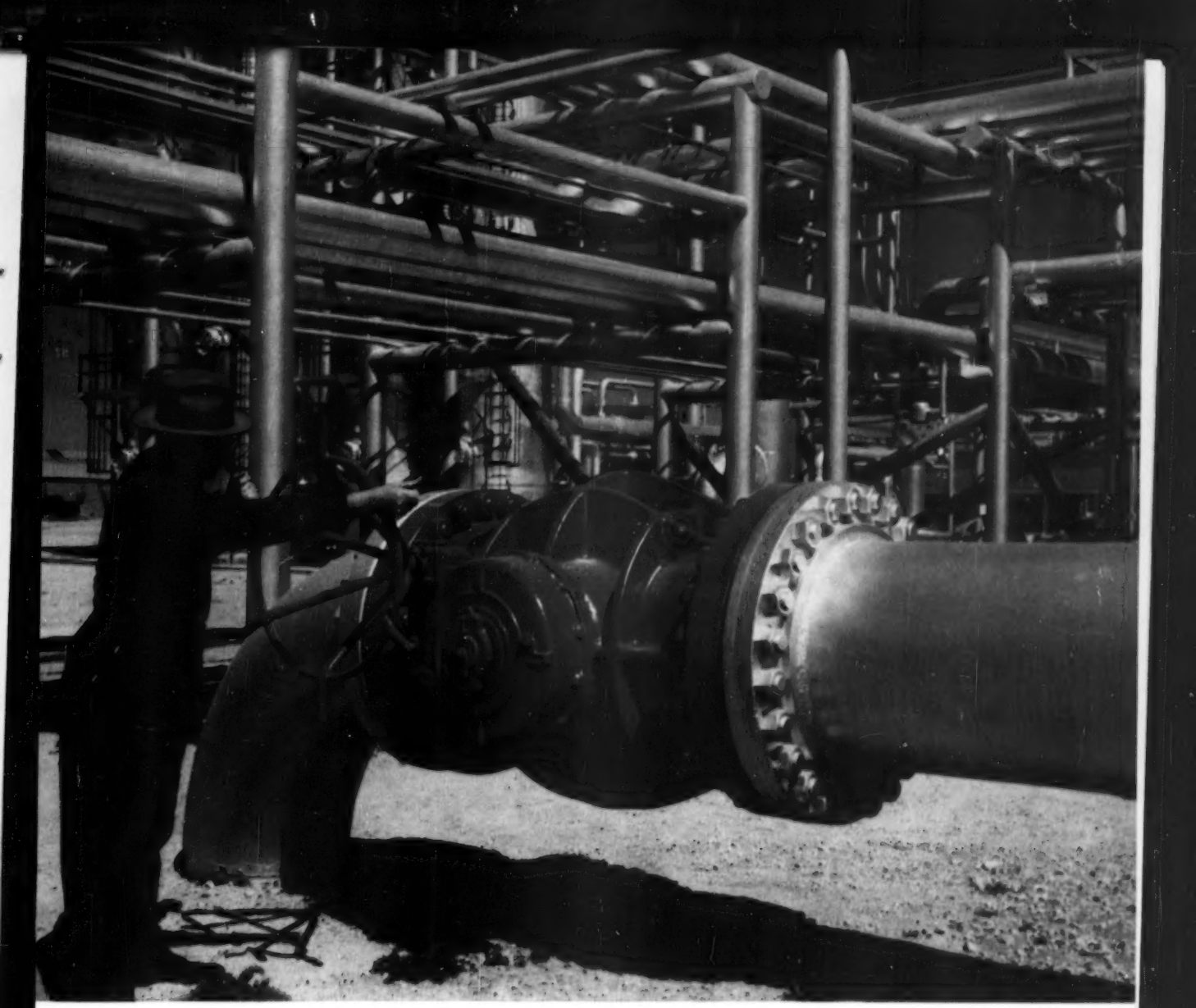
EASY WAY TO DESIGNING MODULAR HEAT EXCHANGERS. PAGE 197

Bob Callard is supervisor of the plant equipment section, technical products division, Corning Glass Works, Corning, N. Y.

He has sound experience in technical sales, as well as in equipment development and design. In fact he started off with Corning in 1942 as a sales engineer, then worked his way up through merchandising manager of standard product sales to his present position.

Thoroughly sold on the advantages of modular heat exchangers, Bob works closely with the sales engineers of the division as a consultant. Besides this, his section is active in the development of new glass equipment particularly for chemical processes, and in the adaption of glass equipment to special problems.

A graduate of the Univ. of Mich. with a BS in chemical engineering (1935) he started working with the H. O. Trerice Co. of Detroit as a sales engineer. He then served successively as a development engineer for the McAleer Manufacturing Co. and



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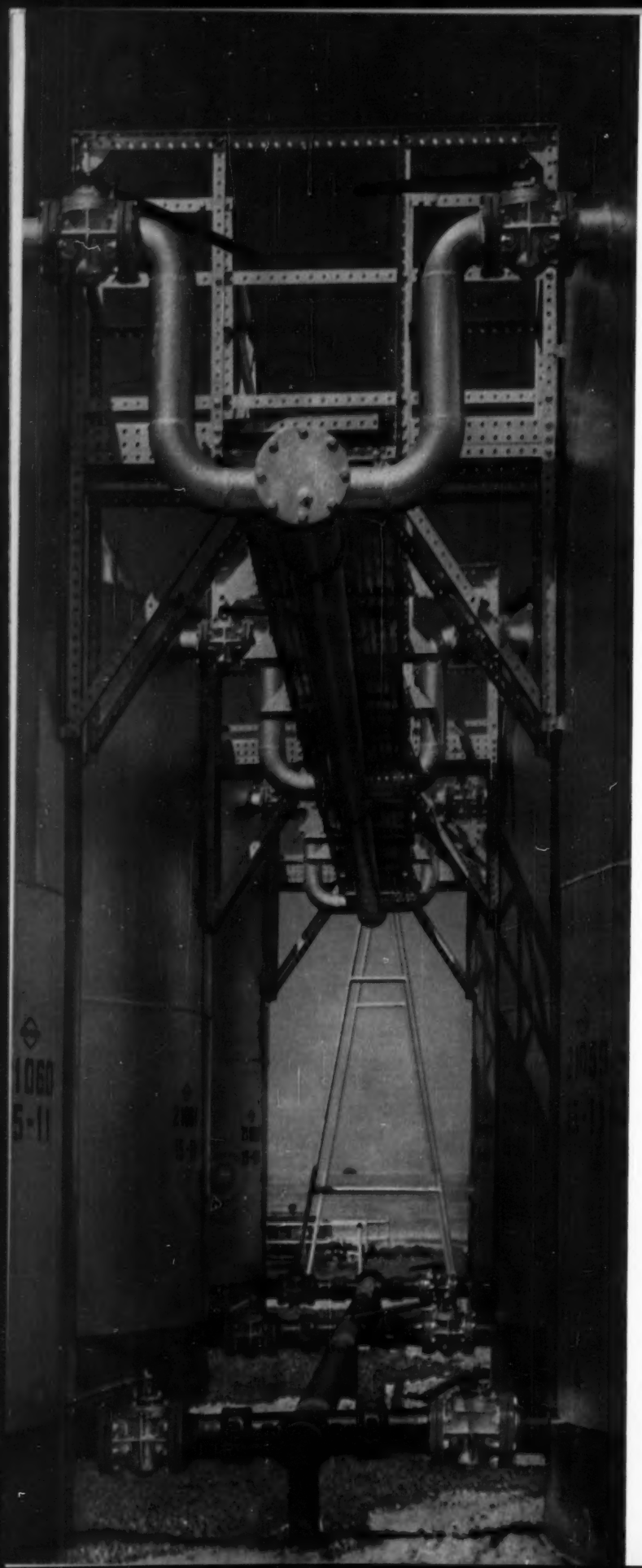

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development supervisor for American Brakelok.

Howard Willett

SELECTION OF MATERIALS FOR GAS SCRUBBERS. PAGE 228

While Howard Willett protests that he is no expert on corrosion, his practical experience with the application of construction materials to gas scrubbing systems handling corrosives under widely-varying process conditions speaks for itself.

Mr. Willett is currently manager of the P-A Scrubber Dept., Chemical Construction Corp., New York, N. Y., where he has been employed for the past seven years. Prior to this, he spent four-year stretches of "basic training" with Air Reduction Co., Stamford, Conn.; General Chemical Co., North Claymont, Del.; and National Lead Co., Brooklyn, N. Y.

With the recently-announced transfer of Chemical Construction Corp. from American Cyanamid Co. to Electric Bond and Share Co., Mr. Willett will become an employee of the latter organization. Electric Bond and Share intends to strengthen and expand Chemico's services to chemical industry clients—particularly in the field of organic chemicals in which Chemico already has extensive experience.

Mr. Willett is a member of the American Chemical Society and the Air Pollution Control Association. He and his family reside in Old Greenwich, Conn.

This month's Corrosion Forum article is based on Mr. Willett's paper presented at the Nov. 1955 Southeast Regional Meeting, National Association of Corrosion Engineers.

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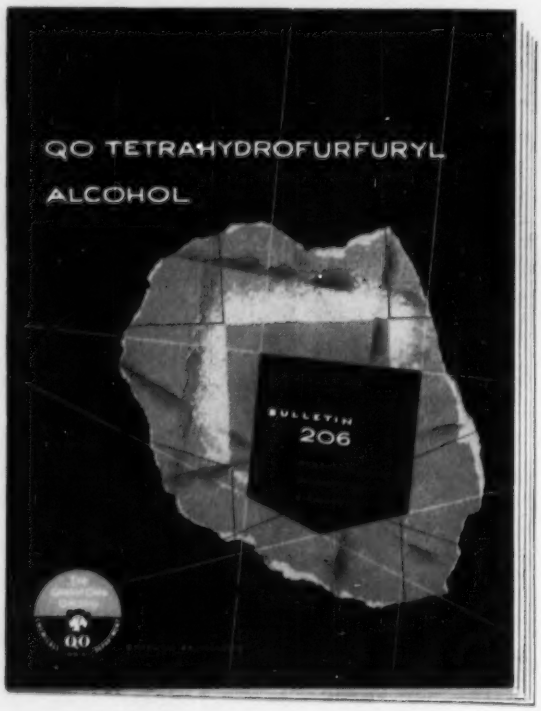

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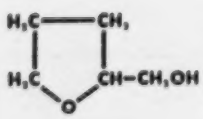

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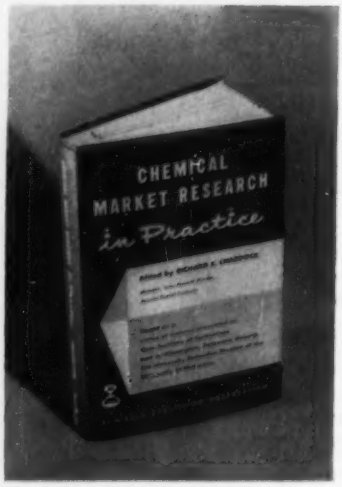
THIS MONTH'S

Technical



"No company today can afford to do no market research at all."

CHEMICAL MARKET RESEARCH IN PRACTICE. Edited by R. E. Chaddock. Reinhold Publishing Corp., New York. 196 pages. $3.

As President Pete Neidig of the Chemical Market Research Association points out in his foreword, this subject has come a long way since that organization was officially founded in 1940. He might have gone back even farther to the abortive efforts of the three "Alkali Ikes"—Wittenberg, Davies and Ross—who were aided and abetted by editors of this magazine's predecessor, the old *Chem. & Met.* But despite its hesitant start and questionable parentage, chemical market research has had a most remarkable growth in numbers and influence.

The secret of that success has been carefully concealed in the pages of this little book. It is the spirit of cooperation and mutual confidence that has made possible a great cross-fertilization of ideas from many different fields and functions of industry. The several hundred man-years of experience that were compressed into these 16 chapters represent the work of research

Bookshelf

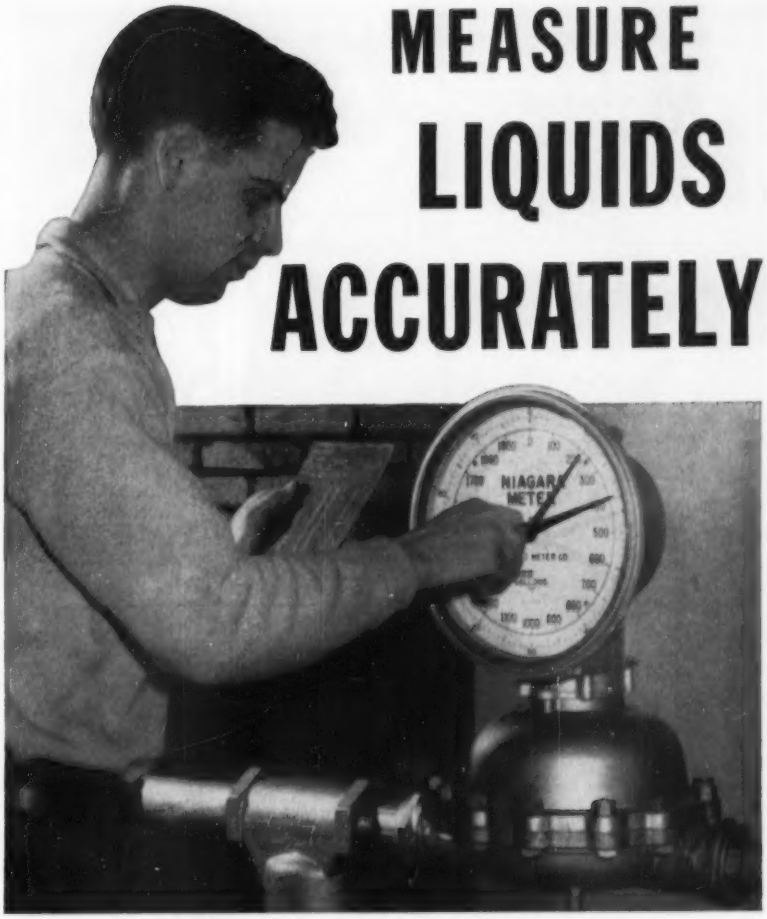
EDITED BY R. K. GITLIN

chemists and engineers, economists and statisticians, salesmen and purchasing agents, bankers and business executives. The task of welding these varying viewpoints into a unified approach to the problems of market research was the difficult, almost impossible assignment Dick Chaddock of Hercules undertook as editor of this valuable volume. He has succeeded far better than his sponsors had reason to expect.

All this started through an organized effort to introduce the college student to the important role of market research in the chemical industries. Prominent members of CMRA presented two series of lectures at the Case Institute of Technology and the University of Delaware. They range all the way from Bob Wittenberg's over-all introduction of market research to an illuminating series on the organization and growth of such colorful industries as plastics, synthetic fibers, detergents and petrochemicals; from Parker Fresselle's chemical market survey to detailed departmental case study from the rubber industry; from the Lawrence-Sprague discourse on the effective use of the literature to a classic sermon on the human equation by the Messrs. Park and Schram.

By this time the student may well have been confused if not discouraged by the tremendous breadth and depth of the subject thus unfolded. But well dispersed throughout the series were several eminently practical lectures on how to do field work by Sam Koonce, how to present your results by Dick Warren and Bob Prather, how to integrate technical and market research by Bob Cairns. Even those aspiring to top administration jobs would be impressed and helped by the chapter on policy planning and finance by Dick Schneider of Empire Trust and Tony Williams of Celanese.

All these and other equally prominent contributors whose names I have failed to mention



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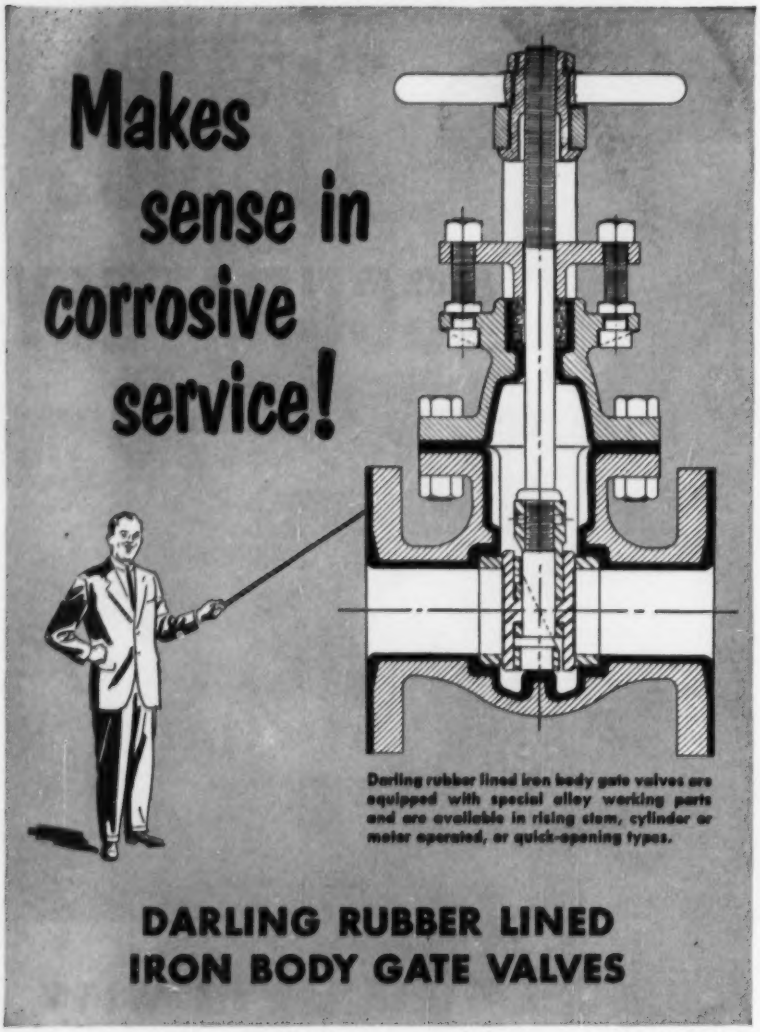
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are to be congratulated for their contribution to the literature of this new and still amorphous mixture of science, art and skill. And, whose fault is it if each, like this reviewer, sometimes sees chemical market research only from the vantage point of his own individual interest and experience?—SDK

High Temperatures

HIGH TEMPERATURE TECHNOLOGY. Edited by J. E. Campbell. John Wiley & Sons, New York. 526 pages. $15.

Reviewed by N. K. Hiester

The 1951 meeting of the Electrochemical Society, in Washington, D. C., featured a symposium on "High-Temperature Materials, Methods and Measurement." This book is a result of the expression by those in attendance that a monográph summarizing recent developments in high-temperature technology was needed.

The book is a series of contributions chosen by the editor with the intent of acquainting the reader with a rounded view of established techniques, materials and recent developments. As he points out, the varied background of the authors leads them to different concepts as to what is meant by high temperatures. Generally, however, the monograph deals with temperatures above 1,500 C.

There are three major sections: Materials, Methods and Measurements. The first is a series of articles covering metals, oxides, carbon and graphite, carbides, borides, silicides, nitrides, sulfides and cermets. In the main, these are well written and, if not the latest and most complete sources of information in some cases, serve as excellent reference materials—since rather copious bibliographies accompany each chapter.

The Methods sections contains some general articles on sintering and means of achieving high temperatures, followed by several specific chapters on resistance and induction-heated furnaces, arc furnaces and other methods. This section is the weakest one because it describes

only some very specific furnaces, rather than presenting a broader discussion of the operation, performance, advantages and disadvantages of the various furnace classes. It also suffers from a lack of completeness in that combustion furnaces aren't, even in a general way, reviewed. Instead, the reader is referred to another book. Of all the chapters in this group, the one on arc furnaces is the most satisfactory.

Section No. 3 (Measurements) discusses methods of determining temperature, mechanical properties, physical properties (e.g., thermal conductivity) at high temperatures and special techniques such as high-temperature microscopy and X-ray diffracion measurements. These chapters are very useful in describing procedures. They're well chosen and prepared.

As pointed out above, this book suffers a little in spottiness because there are many contributors. In a few cases, the tendency is to describe only products of the company with which the author is affiliated. All in all, however, there is much good information here. And this monograph should serve as an important basic reference for those interested in high-temperature technology.

For the First Time

THE COLLOID CHEMISTRY OF SILICA AND SILICATES. By R. K. Iler. Cornell University Press, Ithaca. 324 pages. $5.50.

Reviewed by G. L. Kalousek

This monograph brings together—for the first time—an excellent, though in places somewhat brief, coverage of the colloid chemistry of silica and silicates. Chapters such as "Silica-Water System," "Soluble Silicates," "Silicic Acid" and "Silicic Esters" emphasize the state of polymerization and colloidal behavior. And they augment critically previous treatments of these subjects. The author bases theoretical discussions on the common denominator of structure. This presentation gives the book a smooth continuity of thought which makes for easier reading. Application of theory

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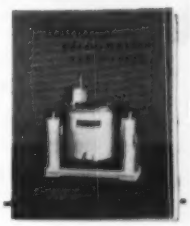

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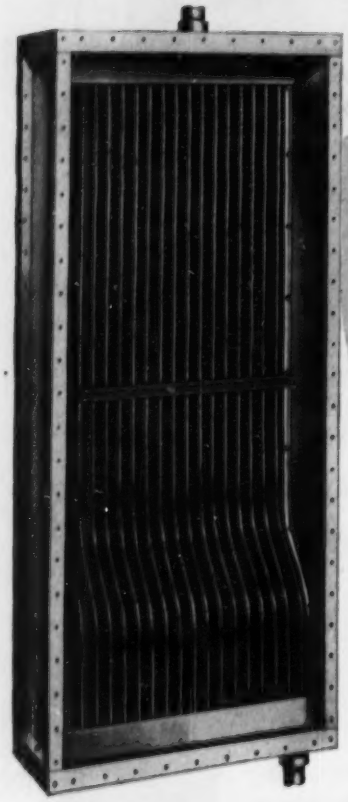

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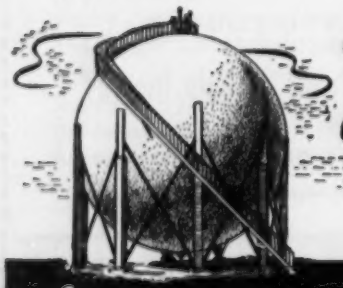

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to practice is handled in a simple, understandable manner.

The chapter on colloidal silicates, amply illustrated with electron micrographs, relates effectively colloid chemistry and mineralogy of technically important minerals. Discussion on surface chemistry is an excellent review of a field of science particularly important to the main subject. The text closes with a chapter on silica in living organisms—a highly interesting and unique summary not previously presented in books on silica and silicates.

This volume is a fine addition to the library on colloid, silica and silicate chemistries—and related fields of science. It should prove to be a highly valuable reference to a wide list of readers. A complete and up-to-date bibliography at the end of each chapter, and an adequate index, more than compensate for the understandable brief discussions of some of the topics.

Strictly Practical

PRINCIPLES OF CHEMICAL ENGINEERING THERMODYNAMICS. By E. D. Wilson and H. C. Ries. McGraw-Hill Book Co., New York. 376 pages. $7.50.

Reviewed by H. Y. Krinsky

Years ago while working through the maze of subjects comprising an undergraduate course in chemical engineering, I came to the conclusion that it was possible to pass thermo without really understanding the fine points of the science.

Having taught the subject for several years, I am now convinced, unhappily, that this is so. There is much to be said in favor of the practical approach to thermodynamics as opposed to the theoretical approach. It is sometimes disheartening to get only dazed expressions after a lecture on the finer points of, say, the fugacity concept. Undaunted, however, I believe that the finer points can be taught at the undergraduate level.

My opinions notwithstanding, this solid, practical text on the

third-year college level is a welcome addition. Wilson and Ries have written their book with the stated intention of presenting a course with emphasis on industrial applications. This course in thermodynamics is intended to parallel the usual physical chemistry taken by chemical engineers.

The authors have presented the usual subjects in chemical engineering thermo in a concise, clear and trimmed down version. No advanced theoretical work is included and every chapter can be used as is.

In this text you'll find a logical flow of subject material, clear development of ideas, full use of calculus, up-to-date charts and data, interesting illustrations and practical problems. There is an excellent section on checking thermodynamic data. But you will not find a philosophical exposition of the Second Law, nor will you find the derivation of the absolute temperature scale or a description of low-temperature refrigeration methods.

But as the authors state, "Opinions on the importance of certain phases of the subject are bound to vary. . . . This is inevitable when a tool of so many uses is considered in a field of such a broad scope."

At the level for which the authors have written this text, it is extremely practical and eminently teachable. And quite aside from its use as an undergraduate text, it should prove an excellent aid in reviewing basic thermodynamic principles.

Fine Critical Evaluation

DETERMINATION OF ORGANIC STRUCTURES BY PHYSICAL METHODS. Edited by E. A. Braude and F. C. Nachod. Academic Press, New York. 810 pages. $15.

Many organic chemists and some physical chemists will soon add this book to their reference shelves—if they haven't already done so. Its critical evaluation of methods makes it a fine record of contemporary theory and techniques.

The problem of organic struc-

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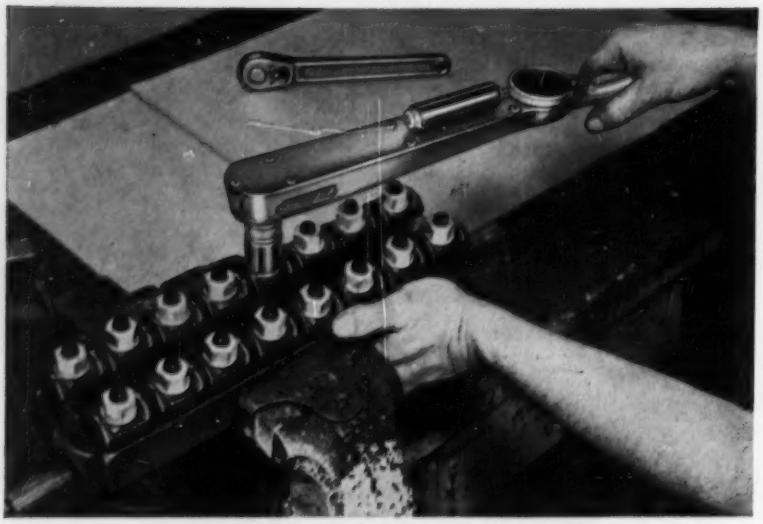

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tures is broken down into three parts: determining molecular size, molecular pattern, and molecular fine structure. The 16 chapters cover as many different methods of attack on the problem—from phase properties through microwave spectroscopy to reaction kinetics as applied to structural problems.

Chemical engineers will find the various methods to be of academic interest.—LBP

BRIEFLY NOTED

BOUNDARY LUBRICATION STUDIES OF TYPICAL FLUOROESTERS. 42 *pages.* $1.25. *By R. C. Bowers, et al. Order PB 11906 from Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.* Results of investigation of boundary lubricating and wear-preventive properties of some new fluorinated diesters offering advantages as high-temperature lubricants.

ZIRCONIUM—TECHNOLOGY AND ECONOMICS. 125 *pages.* $3. *Atomic Industrial Forum, 260 Madison Ave., New York 6, N. Y.* Report based on proceedings of a two-day Forum meeting. Includes papers and discussions on chemistry and production of metallic zirconium, fabrication, properties, corrosion behavior, alloys, supply of raw and refined materials, commercial products available, future AEC and industrial requirements.

NUCLEAR ENERGY. 188 *pages.* 600 *fr. Presses Documentaires, 28 Rue Saint-Dominique, Paris 7, France.* Special report dedicated to the principles set forth at 1955 Geneva conference. Published by *Chimie & Industrie,* with cooperation of AEC and a number of its collaborators. Report comprises 16 articles, followed by detailed analyses of some 60 papers presented at Geneva on industrial chemistry of nuclear energy and diverse applications of radioactive isotopes.

ANNOTATED BIBLIOGRAPHY ON THE USE OF ORGANOLITHIUM COMPOUNDS IN ORGANIC SYNTHESIS. SUPPLEMENT NO. 4. *Lithium Corp. of America, Inc., 2527 Rand Tower, Minneapolis 2, Minn.* Contains abstracts of 271 papers published during 1954 and 1955. Abstracts are listed alphabetically by author and are numbered consecutively. Index of

compounds mentioned is included. Copies of original bibliography and supplements 1, 2 and 3 are also available from the Lithium Corp.

BIBLIOGRAPHY OF SOLID ADSORBENTS, 1943 *to* 1953. 1,528 *pages.* $8.75. *By V. R. Deitz. Circular 566, National Bureau of Standards, U. S. Dept. of Commerce, Washington 25, D. C.* Annotated bibliographical survey containing about twice as many references as are found in the 1900 to 1942 bibliography. Contains complete author and subject indices.

SOLAR RADIATION, ABSORPTION RATES, AND PHOTOCHEMICAL PRIMARY PROCESSES IN URBAN AIR. 140 *pages.* $5. *By P. A. Leighton and W. A. Perkins. Air Pollution Foundation, 704 S. Spring St., Los Angeles 14, Calif.* Traces process of photodissociation by which nitrogen dioxide in the atmosphere is broken up by sunlight into nitric oxide and oxygen atoms—leaving single oxygen atoms free to combine readily with air's oxygen molecules to form ozone. Authors show that nitrogen oxides, as well as hydrocarbons, must be reduced to minimize smog effects.

ACCIDENTAL SCIENTIFIC DISCOVERIES. 64 *pages. Schaar and Co., 754 W. Lexington St., Chicago 7, Ill.* Includes stories about the chance discovery of oxygen, X-rays, rayon, photo-sensitive plates, amiline dyes, plastics and other historic scientific advances. All stories originally appeared in an external house organ published by the Schaar Co.

MORE NEW BOOKS

CHEMICAL APPLICATIONS OF SPECTROSCOPY. Edited by W. West. Interscience. $15.

CHEMICAL PROCESS INDUSTRIES. 2nd ed. By R. N. Shreve. McGraw-Hill. $11.50.

EXPERIMENTAL THERMOCHEMISTRY. Edited by F. D. Rossini. Interscience. $7.80.

MODERN CHEMICAL PROCESSES. Vol. 4. Reinhold. $5.

MOLECULAR FLOW OF GASES. By G. N. Patterson. Wiley. $7.50.

PHYSICAL CHEMISTRY. By N. K. Adam. Oxford. $8.

THE CHEMISTRY OF PHENOLIC RESINS. By R. W. Martin. Wiley. $9.50.

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THIS MONTH'S

Firms in

NEW COMPANIES

British Titan Products Co., York, England, and African Explosives and Chemical Industries, Johannesburg, have formed a company in South Africa for the manufacture of titanium dioxide pigments. A plant near Durban is expected to go on stream toward the end of 1958.

Herner, Meyer and Co., Washington, D. C., has been formed to conduct a program of services in the planning of libraries, the design of information systems, and the organization and conduct of informational surveys.

Richardson Scale Co., Ltd., has been formed by Richardson Scale Co., Clifton, N. J., to manufacture and market its automatic scales and proportioning equipment in England.

Hastings-Raydist, Inc., Hampton, Va., has been formed through consolidation of Hastings Instrument Co. and Raydist Navigation Corp.

Griscom-Russell-Schack Co. has been formed to manufacture a metallic shell and tube heat exchanger known as the Schack Recuperator. It is jointly owned by Griscom-Russell Co., Massillon, Ohio, and Schack Rekuperator Co., Dusseldorf, Germany.

Institute of Rubber Research has been formed by the University of Akron to conduct basic research on natural and man-made rubber under government and industrial contracts.

Du Pont Co. (United Kingdom) Ltd. has been formed by Du Pont, Wilmington, to provide herbicides of British manufacture for the British market.

Western Charcoal Corp. has

the News

EDITED BY F. ARNE

been formed to manufacture 6,000 tons/yr. of hardwood charcoal from alder at a new plant in Renton, Wash.

NEW FACILITIES

Liquid Carbonic Corp. has acquired Western Oxygen, Inc., Seattle, Wash., producer of oxygen, acetylene and medical gases.

Beckman Instruments, Inc., Fullerton, Calif., has established a data and control systems department to concentrate on automatic data processing and the ultimate linking of instrumentation with digital computers.

Metal & Thermit Corp. has started a $750,000 titanium ore dressing plant at Beaver Dam, Va., which will produce both rutile and ilmenite.

Monsanto Chemicals of England has opened a new polymer research laboratory at Newport, England, which houses the only industrial radiation research facilities in the country.

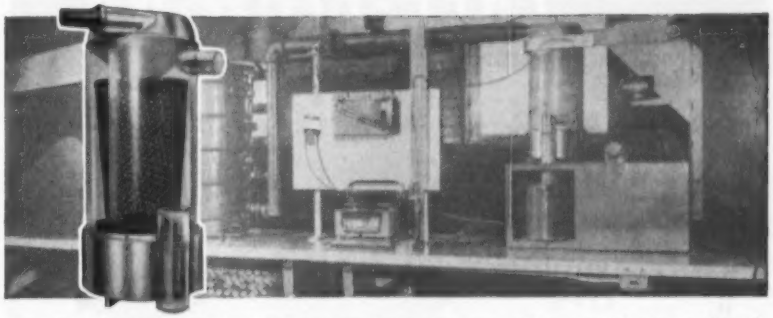
International Minerals & Chemical Corp., has started production of nepheline syenite from its mine at Blue Mountain, Ont. The product is a ceramic raw material, mainly used in the manufacture of glass where it is a source of alumina and alkali.

Alaska Pine & Cellulose Ltd. plans to boost chemical cellulose capacity at its Port Alice, B. C., plant to 125,000 tons/yr. compared to the present 75,000 tons.

Compania Quimica S. A. has opened the first azoic dyes plant in Argentina at Buenos Aires.

Monsanto Chemical Co. has doubled its capacity to produce vinyl chloride polymers and copolymers with the

New laboratory machines aid chemical process research and development



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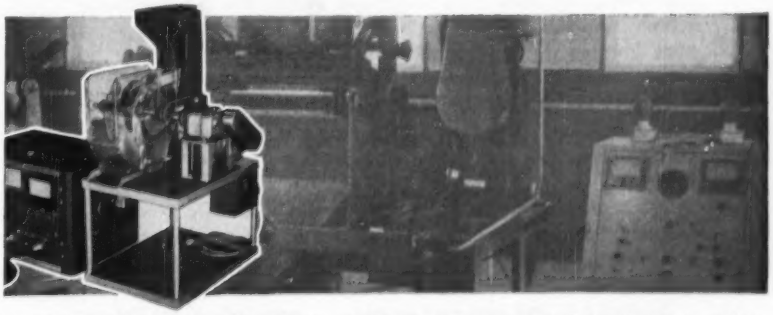
SUPERIOR AIR JET SEPARATOR — This new machine accurately determines whether or not materials can be separated by terminal velocity. It also determines the extent to which they may be separated. In the separating process, material falls in a thin curtain through 3 high-velocity air streams. The Air Jet Separator is portable . . . may be plugged in and operated anywhere in plant.



SUPERIOR "CORONATRON"® — Here's an electrostatic separator that effectively makes non-magnetic, same-size, same-weight separations. It is the most flexible, least expensive unit of its type available. It adjusts to both high and low intensity electrostatic concepts for adaptation to various separation problems. Multiple separating zones permit complete separation from this single unit.

CALL OR WRITE for complete information on these new laboratory separators. We are prepared to run samples to determine which machine best solves your problem.

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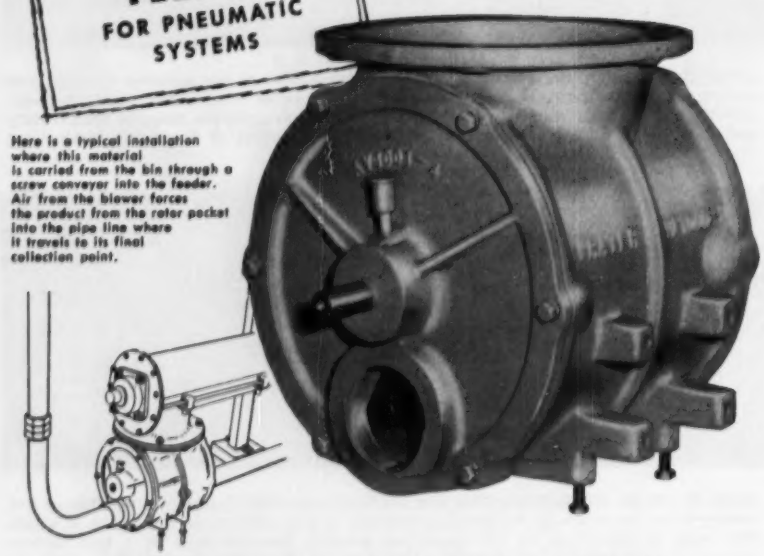
NEW! FOR HANDLING FREE-FLOWING PRODUCTS

PRATER BLOW-THRU FEEDER
FOR PNEUMATIC SYSTEMS

Here is a typical installation where this material is carried from the bin through a screw conveyor into the feeder. Air from the blower forces the product from the rotor pocket into the pipe line where it travels to its final collection point.



No matter how attritionized the product, this new Prater Blow-Thru Feeder will feed it efficiently and quickly into any pneumatic system. And this new design becomes an integrated part of the pipe line and will feed against pressures as high as 10 PSIG . . . either positive or negative!

One of the efficient design features of this unit is that on the horizontal center line of the body casing is a pressure neutralizing port to bring the rotor pockets to atmospheric pressure before filling.

There are many other interesting and high quality production features. Power requirements vary according to the fineness and abrasiveness of the product . . . flour, salt, carbon or any other material.

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FIRMS . . .

opening of new facilities at Springfield, Mass.

General Reduction Co. has built a 100% increase in capacity into its special clay processing plant at Macon, Ga.

Mitsui Petrochemical Industries, Ltd., plans to build the first petroleum chemicals plant in Japan at Iwakuni City. To be completed late in 1957, the $30-million unit will produce ethylene oxide, ethylene glycol for anti-freeze and synthetic textiles and cumene.

United States Radium Corp. has bought the luminescent pigment business of New Jersey Zinc Co. U. S. Radium will manufacture the materials at its Whippany, N. J., plant.

United Carbon Co. will take part in building a $6-million carbon black plant near Melbourne, Australia. It will be jointly owned by Shell Chemical (Australia).

University of Maine has received a gift of a $40,000 pilot plant machine capable of coating paper by any of the present methods. Donor was Hercules Powder Co.

Laclede-Christy Co. has started a $1.5-million expansion program at its St. Louis, Mo., plant to increase production and improve quality of its refractory castables and mortars. At Clearfield, Pa., the company will increase fire brick production by 15%. A new chemical laboratory has just been added to its physical testing and petrographic laboratories in St. Louis.

Atlantic Refining Co. will build an absorption gasoline plant, capable of handling up to 25 million cu. ft. of gas a day near Crane, Tex.

American Viscose Corp. plans to double the size of its research and development quarters at Marcus Hook, Pa.

Packing Engineering Corp. is back in full production hav-

ing acquired new quarters after a fire at its Cranford, N. J., plant.

Foster Grant Co. has doubled the capacity of its styrene monomer plant at Baton Rouge, La., increased capacity of its polystyrene plant in Leominster, Mass., by 50%, and tripled the size of its research laboratory.

Eli Lilly and Co., Indianapolis, plans to build a $3-million agricultural research center on the site of its present Greenfield, Ind., laboratories.

Sinclair Refining Co. plans to increase high-octane gasoline production through construction of a 7,500-bbl./day catalytic reforming unit at its Wood River, Ill., refinery.

Columbian Carbon Co. is building a $350,000 office and laboratory in Monroe, La., to serve as its Southwest headquarters.

Detrex Corp. has acquired Hooker Electrochemical Co.'s interest in Hooker-Detrex Inc. including that company's plant at Ashtabula. The Tacoma, Wash., plant of Hooker-Detrex will be transferred to Hooker.

Hooker Electrical Co. plans to build a $300,000 addition to its North Tonawanda, N. Y., plant to serve as a product application laboratory.

Abbott Laboratories has tripled plant space at its Oak Ridge operation permitting more of its radioactive pharmaceutical work to be done there.

Pacific Coast Aluminum Ltd. has installed an aluminum anodizing plant at Lulu Island, B. C., where its extrusion has also just been completed.

American Forest Products is building a $1.5-million, 50 ton/day paper mill in Newark, Calif.

Crown Zellerbach Corp. plans

Special "Vest-Pocket" controls for **HAZARDOUS LOCATIONS!**

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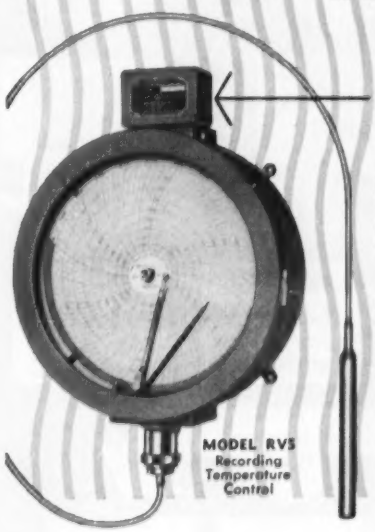
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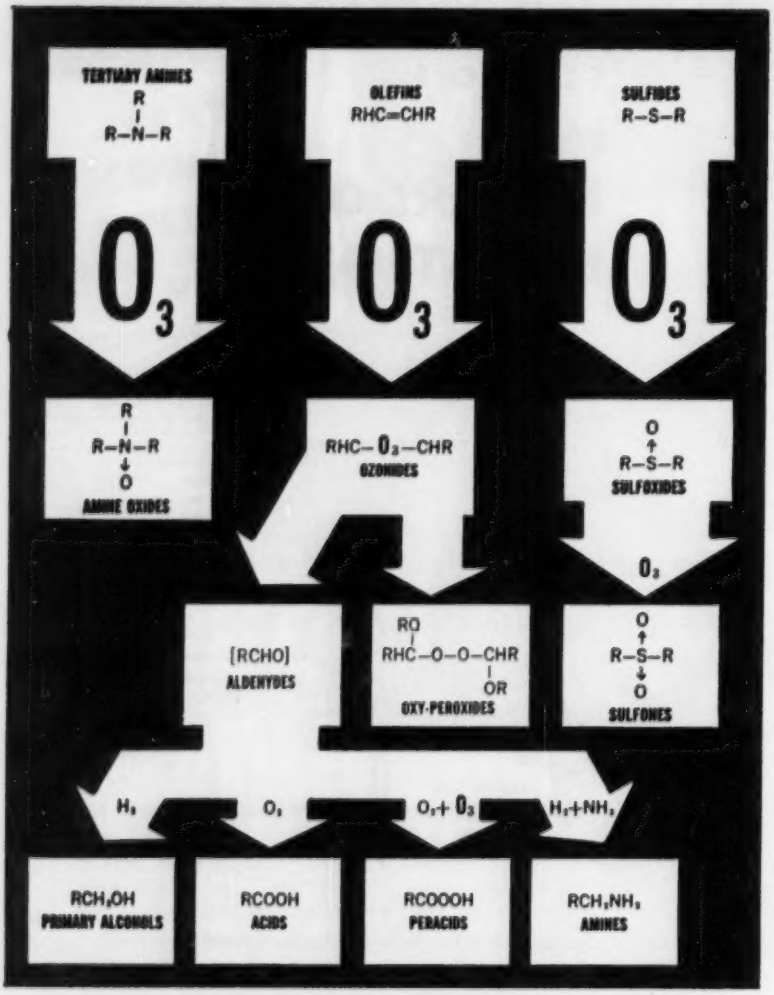

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THE WELSBACH CORPORATION—OZONE PROCESSES DIVISION—1500 WALNUT ST., PHILADELPHIA 2, PA

to double capacity of its recovery boiler facilities at Camas, Wash., with installation of $2-million kraft recovery furnace designed to handle spent liquor from 350 tons of kraft pulp daily.

W. R. Grace & Co's newly-formed polymer chemical division has acquired headquarters and laboratories in Clifton, N. J. The company has also acquired the Cosden Petroleum Corp. of Big Spring, Tex.

Fischer & Porter Co., Hatboro, Pa., has started construction of a $1-million office building.

Gulf Oil Corp. is building two 26,000-bbl./day catalytic reforming units at its Philadelphia refinery.

Southern Nitrogen Co. will complete a $14-million fertilizer plant in Savannah, Ga., by 1957.

Electro Metallurgical Co. has formed a new marketing research division within its sales department which will be responsible for the development of secondary markets for the company's products.

Paramount Paint & Lacquer Co. will double its manufacturing and research facilities at Los Angeles in a $200,000 expansion program.

Stein, Hall & Co. will replace its present plant for textile and adhesive products at Charlotte, N. C., with a new $250,000 plant, office building and laboratory.

Ferro Corp. expects to double present production of its frit and glaze division in Nash-

ville, Tenn., in the next five years, is currently spending about $80,000 for expansion with a planned expenditure of about $200,000 set for next year. And its Nashville fiber glass plant is in the midst of a $1.5-million expansion.

National Carbon Co. plans a 15% increase in capacity of its Columbia, Tenn., plant for production of carbon and graphite electrodes.

Cargill, Inc., will build a 700-ton/day, $2-million soybean processing plant at Memphis, Tenn.

Phillips Chemical Co. will build a sulfur plant in Andrews County, West Texas, adjacent to the natural gasoline plant which the parent company, Phillips Petroleum Co., is now building.

Assn. of Applied Solar Energy, Phoenix, Ariz., has opened a library devoted exclusively to solar energy.

D-X Sunray Oil Co. plans to spend $10 million on expansion of its Tulsa and Sunray Village, Okla., refineries.

Canadian Titanium Pigments Ltd. has begun construction of Canada's first titanium pigment plant at Varennes, Que.

Monsanto Chemical Co. has formed a new domestic subsidiaries division to administer its interests in Shawinigan Resins, Chemstrand, and Mobay.

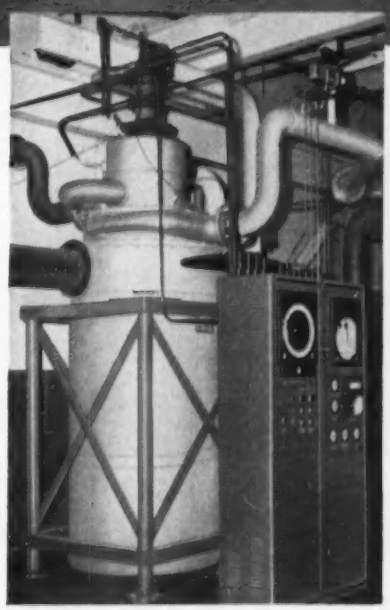
Standard Oil Co. (N. J.) is negotiating with the Norwegian government on plans for a $32-million oil refinery in Skjebergkilen.

Worthington Corp. has acquired Mason-Neilan Regulator Co.

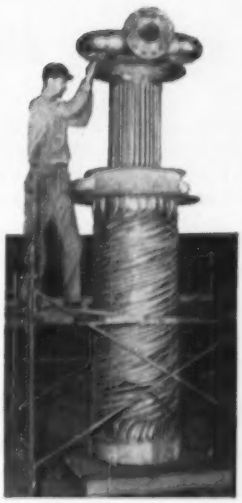
Wellcome Foundation has opened a $1.12-million plant in Dartford, England to manufacture insulin and other injection products.

Department of Defense has re-

THERMAL
FIRED HEAT EXCHANGERS



a compact means of heating air or process gases for testing or production



THERMAL HIGH VELOCITY BURNERS MAKE THESE HEAT EXCHANGERS POSSIBLE . . .

Whether it be an existing standard design or a unit for special requirements, THERMAL heat exchangers provide the ultimate in compactness, high performance and response. These heat exchangers are always designed around the high velocity, clear flame combustion characteristics of THERMAL burners. Convection is thus the primary means of heat transfer thereby promoting uniform metal temperature and longlife. THERMAL Heat Exchangers are supplied as complete package installations including all control and accessory equipment.

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Pressures from 0 to 1500 PSIG. Temperatures from 300°F to 1500°F. Heat transfer ratings from 250,000 BTU/hr to 35,000,000 BTU/hr.

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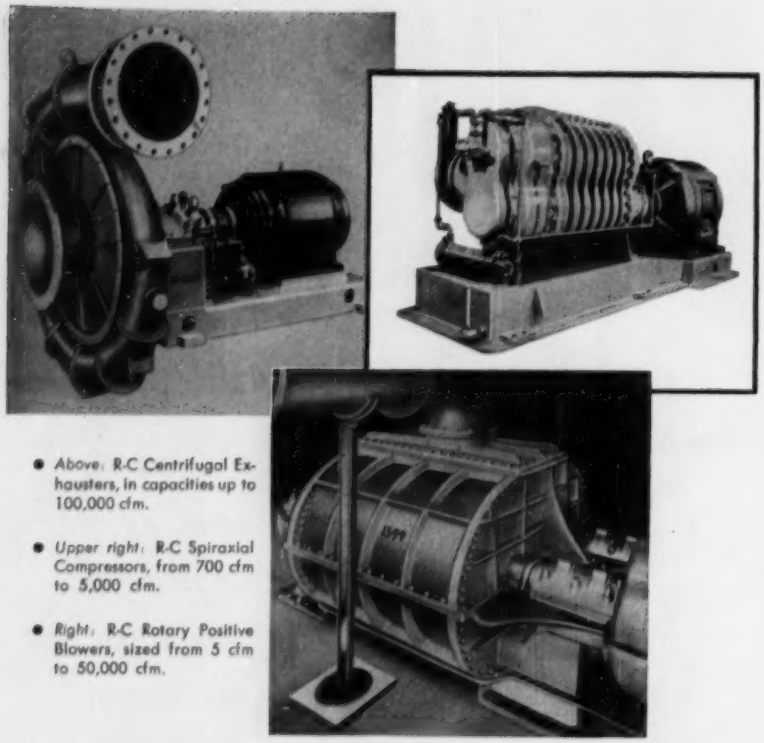

- *Above:* R-C Centrifugal Exhausters, in capacities up to 100,000 cfm.
- *Upper right:* R-C Spiraxial Compressors, from 700 cfm to 5,000 cfm.
- *Right:* R-C Rotary Positive Blowers, sized from 5 cfm to 50,000 cfm.

R-C *plur-ability* PAYS DIVIDENDS WHEN MOVING AIR OR GAS

Where quantity and quality of production depend upon the reliable, economical performance of blowers, exhausters and related equipment, look to the values of *R-C plur-ability.*

- choice of centrifugal, rotary positive and Spiraxial® types, an exclusive advantage of Roots-Connersville.
- accurate control of volume and pressure.
- ample choice of capacities, from 5 cfm to 100,000 cfm.
- high efficiencies and low operating costs.
- low down-time and maintenance expense.
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All these factors add up to *R-C plur-ability.* They work for you in machines which you buy for your own use, or for resale with your equipment, where handling gas or air at moderate pressures is required. Our engineering experience and ability are at your service.

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Whether you use or sell equipment using gas or air at moderate pressures, check *R-C plur-ability.*

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FIRMS . . .

tained Vitro Laboratories, Silver Spring, Md., as engineering consultants to the special project that is guiding the development of ships for launching the 1,500-mi. ballistic missile.

Dominion Rubber Co. Ltd. plans to quadruple laboratories of its Naugatuck Chemical Div. in Elmira, Ont.

United Dye & Chemical Corp., New York, has acquired the Bon Ami Co.

Fuller Paint Mfg. Co. (Philippines) has opened a 300,000-gal./yr. plant at Mandaluyong to produce lacquers, enamels, oils, latex paints and automotive finishes.

Yale Rubber Mfg. Co. is adding to its Sandusky, Mich., plant to accommodate its expanded oil seal division and other rubber-to-metal specialties.

Wilshire Oil Co. of California will complete installation next January of a 10,000-bbl./day unifiner-platformer.

Ethyl Corp. has opened a $500,000 addition to the chemical research laboratories at its Baton Rouge research and engineering center. The company has also taken options on land near Joliet, Ill., as a possible site for a new antiknock compound manufacturing plant.

Petroleo Brasiliero S. A. is expanding capacity of its refinery in Mataripe, Brazil, from 5,000 to 37,000 bbl./day.

Republic Oil Refining Co. is building a crude distillation unit at its Texas City plant to replace several older and smaller units.

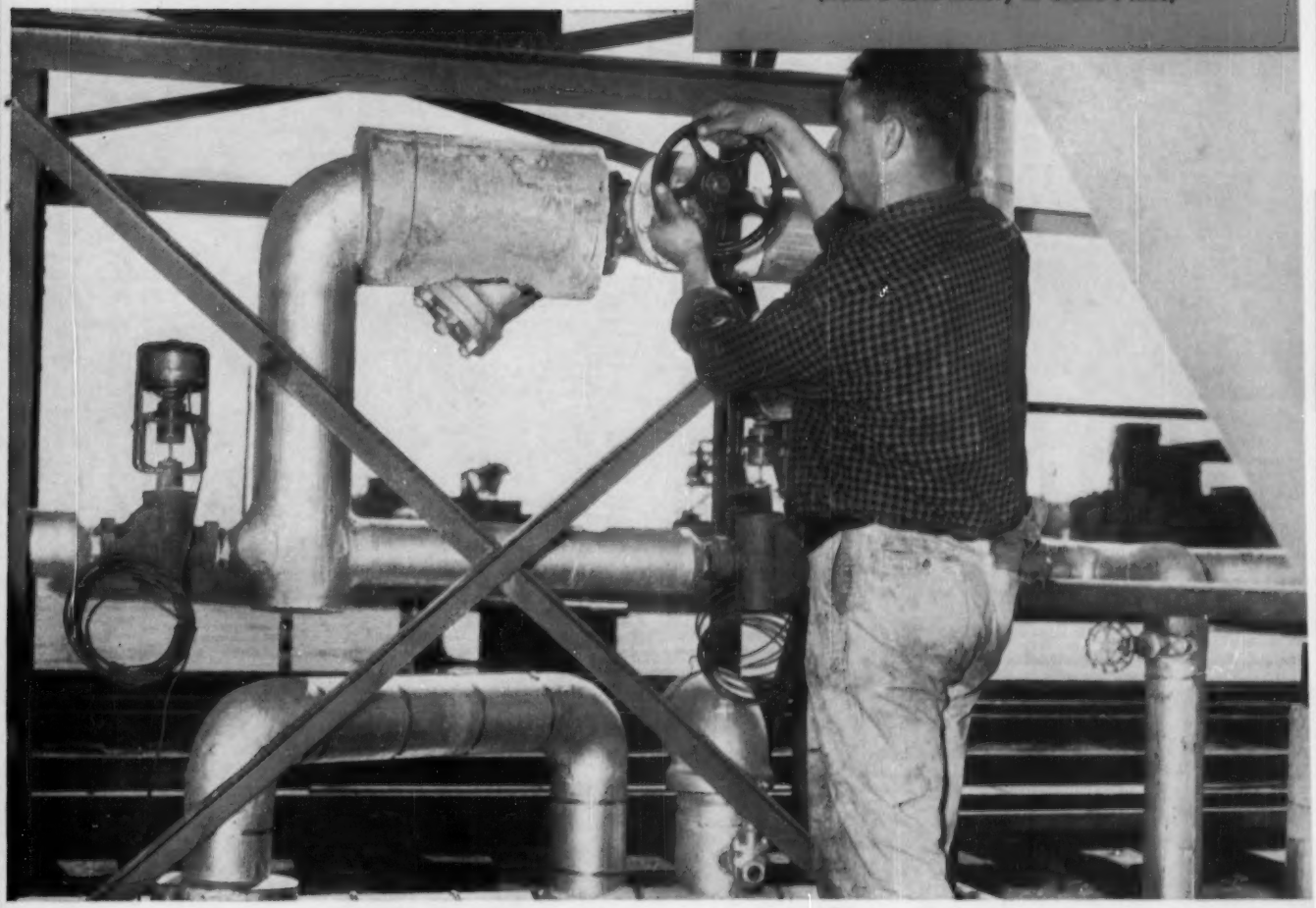
Borden Co. has acquired Resin Industries, Santa Barbara, Calif., manufacturer of vinyl insulation and tubing.

Union Oil Co. of California has completed a $600,000 addition to its Edmonds, Wash., refinery.

Sun Oil Co. has almost com-

INTERESTING FACTS ON VALVE PERFORMANCE

(from a case history in Crane's files)



His job is to wash tank cars . . . not to contaminate them

Even a good washer can contaminate a product tank car unknowingly—it all depends on the valves in the washing system.

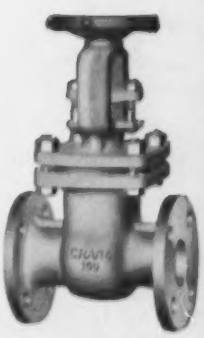
But that isn't happening at the Memphis emulsifiers plant of the Atlas Powder Co. as shown above.

Here, Crane 18-8 SMo stainless steel valves are preventing corrosion and resultant iron pickup from getting into aluminum or stainless steel cars in washing. Such impurities could mean a lot of spoiled products when the cars are loaded.

After more than a year's service on hot detergent solution, the Crane alloy valves show no corrosive effects, and there's no record of damage from contaminants. The valves continue giving positive flow control with no maintenance whatever.

New Crane alloy valves are helping all types of process industries with better flow control, corrosion resistance, and freedom from contamination at low cost. These valves offer many improved service features that can't be duplicated in other makes.

You'll make a sounder investment in alloy valves by knowing the facts on Crane quality. Contact your local Crane Representative or write to address below.



CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

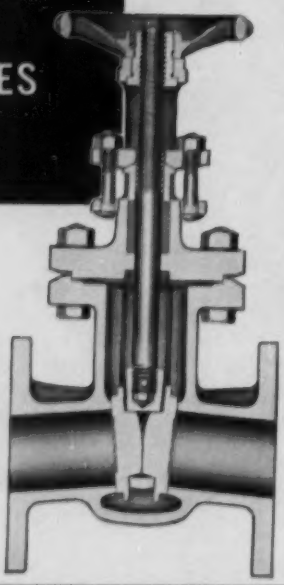
More Facts on Alloy Valves— See Over

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving all Areas

CORROSION MEETS ITS MATCH in these NEW CRANE ALLOY VALVES

in CRANE 18-8 SMo and Craneloy 20

GATES



Cross section, 18-8 SMo or Craneloy 20 Flanged ends, ½ to 12 in. Screwed ends, ½ to 2 in.

It's a fact! These valves will help you combat corrosion in process piping effectively and economically. They're Crane's answer to your need for top-quality stainless steel valves at a competitive price. They give you new improved features for better flow control and longer valve life. You can choose from a complete line of gate, globe and angle patterns, and a companion line of swing checks. All patterns are available in a choice of two alloys—Crane Type 316 stainless, and Crane high-nickel, high-chromium Craneloy 20.

Free-to-Rotate Split-Wedge Disc in Gate Valves

One outstanding feature of these gate valves is the Crane-patented split-wedge seating design. The trunnion-design disc halves are mounted in a carrier pinned to the stem. The discs are free to rotate within their guides. On closure, the convex back surfaces of the discs, bearing against each other, transmit a uniform seating load around the entire seating surface.

Free movement of the discs, plus uniform seating and unseating loads, effectively minimizes galling and seizing at seating surfaces, reduces wear, and assures smooth operation under all conditions. An integral flange on each disc bears in guide slots in the body. Wear on seating surfaces is avoided.

Trunnion-back split-wedge discs with carrier combine the advantages of free rotation with uniform seat load pressure.

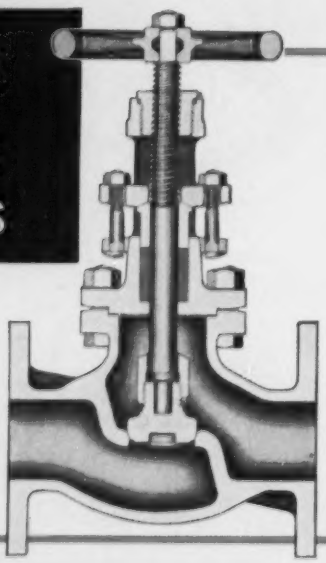
Free Swivel Disc in Globe Valves

Note long engagement with stem for positive, accurate guiding of disc to seat.

In globe and angle patterns, Crane protects these valves against undue seating damage and wear with a new type disc-stem connection. It gives the disc complete freedom to swivel, yet has minimum radial clearances plus elimination of axial clearances to minimize vibration under high velocity flow. By placing seating load closer to seats, it assures easy, accurate closure every time.

The disc of modified plug-type design incorporates the advantages of both narrow ball-to-flat seating, and the greater resistance to damage, erosion or cutting characteristic of the wider area plug-type disc. It permits fine control in flow regulation.

GLOBE AND ANGLE VALVES



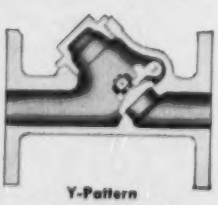
Cross section, globe 18-8 SMo or Craneloy 20 With flanged ends, ½ to 6 in. With screwed ends, ½ to 2 in.

THIS CATALOG IS YOURS

. . . for the asking. It gives complete selection and specification data on new Crane corrosion-resistant alloy valves, with suggested applications. It can help you cut costs of corrosive fluid handling. Ask your local Crane Representative for Circular AD-2080, or write to Crane Co., Chicago 5.

COMPANION SWING CHECK VALVES

These checks are also supplied in both materials—Crane 18-8 SMo and Craneloy 20. Internal design in all patterns assures full and easy flow-through, with positive shut-off against reverse flow. They're compact, easy to maintain. Straightway pattern with flanged ends is made in 2½ - to 6-in. sizes; the Y-Pattern, with flanged or screwed ends, comes in ½ - to 2-in. sizes.



Y-Pattern cross section

pleted a $600,000 laboratory building at its Toledo refinery.

National Lead Co. has taken over operation of AEC's uranium processing mill at Monticello, Utah.

Imperial Chemical Industries plans $5.6-million worth of additions to its fertilizer plant at Billingham, England.

Hope Chemical Corp. has made an exclusive arrangement with Geigy Chemical Corp. through which it takes over the latter's complete dry-cleaning technical sales and service personnel.

El Paso Natural Gas Products Co. will complete a crude oil oil refinery near Gallup, N. M., in the fall of 1957.

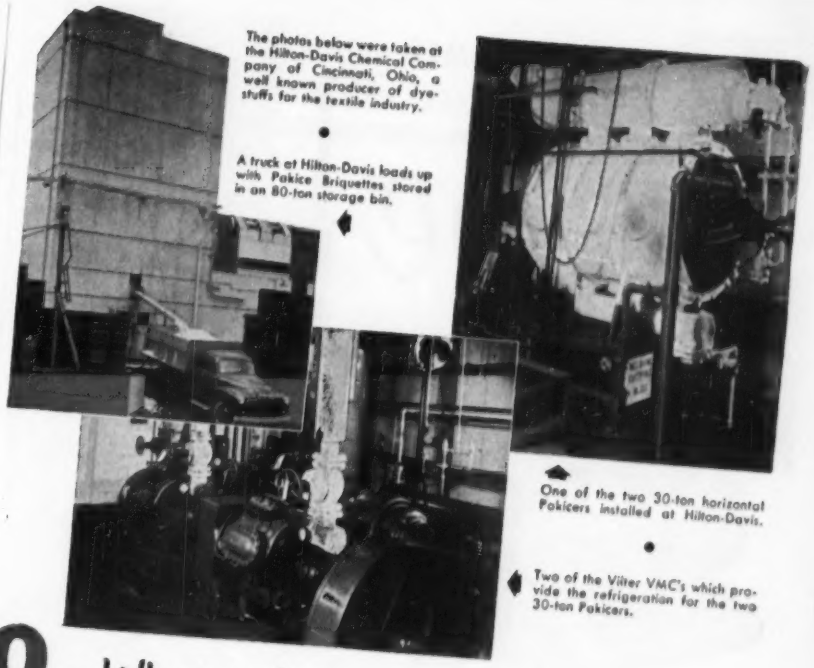
Jones & Laughlin Steel Corp., Pittsburgh, has started production on its new $6.25-million continuous hot-dip galvanizing line which has a 7,000-ton/mo. capacity for galvanized sheets. Above, cold roll stock for galvanizing on a 300-ft. loop car conveyor.

Hewitt-Robins, Inc., will build its first polyurethane foam plant in Franklin, N. J.

Electric Bond and Share Co. has acquired Chemical Construction Corp., formerly a subsidiary of American Cyanamid Co.

Atomic Energy Commission has installed a hydrogen liquefier laboratory at Brookhaven National Laboratories, Upton, N. Y.

Celanese Corp. of America has



The photos below were taken at the Hilton-Davis Chemical Company of Cincinnati, Ohio, a well known producer of dyestuffs for the textile industry.

A truck at Hilton-Davis loads up with Pakice Briquettes stored in an 80-ton storage bin.

One of the two 30-ton horizontal Pakicers installed at Hilton-Davis.

Two of the Vilter VMC's which provide the refrigeration for the two 30-ton Pakicers.

Q - What is the most economical way to cool dyes in a chemical plant?

A. use Vilter REFRIGERATION that costs less to own*

In the production of dyestuffs, much unwanted heat is generated. One of the most practical methods for removing this heat is to use ice, both directly and in latent heat storage. For many years the Hilton-Davis Chemical Company purchased large quantities of expensive block ice for this job. Then Vilter field personnel proved the superiority of freezing and using Vilter Pakice Briquettes.

With Vilter Pakice equipment in the chemical as well as other industries, you can manufacture your own ice and save as much as 50% over other methods. In cases other than solution cooling, where air or product cooling is desirable or necessary, Pakice Briquettes also find favor. These hard, cold Briquettes, scientifically designed for minimum contact, pack closely, yet allow free passage of air over their surface. Actual tests prove that Pakice Briquettes cool to lower temperatures faster.

The source of refrigeration for the Pakicer are Vilter VMC ammonia compressors designed for a long life and trouble-free operation. Investigate Vilter's refrigeration and special heat exchanger experience to help you with your refrigeration problems.

Sold and Installed by Vilter Distributor, C. P. Wood and Company, Cincinnati, Ohio.

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

Vilter

QUALITY CRAFTSMANSHIP that lasts . . .

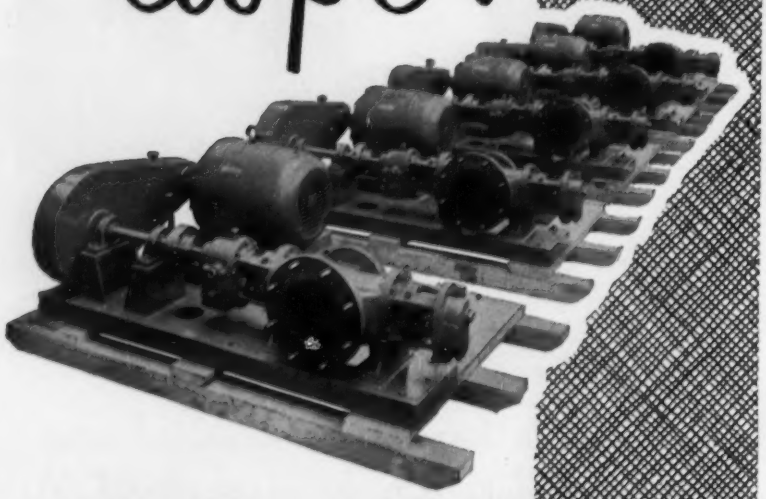
ENGINEERING DESIGN that guarantees performance

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

Here's the dope!



ACETATE DOPE, to be exact. This is the material—with a viscosity at O.T. of 450,000 CP, operating temperature 140°F.—that is being satisfactorily handled by these five

WARREN-QUIMBY

#3¼ External Gear and Bearing Screw Pumps

together with seven more,
all built for the Rome plant of

Celanese Corporation of America

a leading producer of chemical fibers.

These pumps are of special design, with straight-through oversize connections on body; complete with flexible coupling, base, jack shaft, pillow blocks, sprockets, chain guard, and motor with sliding base. Built for variable pressures from 20 to 300 PSIG.

If you have difficult-to-handle liquids, unusual conditions or requirements, Warren-Quimby Engineering and Warren-Quimby pumps pay off.

co-6

WARREN QUIMBY PUMPS

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.

Warren, Massachusetts

FIRMS . . .

budgeted $100 million for expansion over the next five years.

Esso Standard Oil, S. A., will spend about $20 million on modernization and expansion of its Havana, Cuba, refinery.

Minneapolis-Honeywell Regulator Co. plans to establish its expanding transistor division in a new location in the Boston area.

Strong-Scott Mfg. Co., Minneapolis, has formed an industrial equipment division to handle equipment on size reduction, separation and mixing for the process industries.

Stauffer Chemical Co. plans to build a $300,000 addition to its dock facilities on the Ohio River at Louisville, Ky. It would be equipped to handle unloading of 175-ft. chloine barges which provide raw material for its petrochemical plant.

St. Regis Paper Co. has completed a new multiwall bag plant at Kansas City, Mo.

National-Standard Co. plans a 50% expansion of facilities for production of nickel coated steel wire at Niles, Mich.

Nuclear Corp. of America has acquired Isotope Specialties Co., Burbank, Calif., manufacturer of organic and inorganic radio-chemicals.

Lockheed Aircraft Corp. will build new aircraft facilities near Dawsonville, Ga., and operate them in connection with the Air Force's nuclear powered aircraft development program.

Pacific Northwest Alloys Co., Spokane, has signed a $1-million contract with Spokane Natural Gas Co. for 1.3 million cfd. of gas for the next five years.

Rem-Cru Titanium, Inc., has opened sales offices in both New York and Chicago.

NEW REPRESENTATIVES

General Mills' chemical division has appointed Dearborn Chemical Co., Chicago, as exclusive sales agents to the petroleum industry for its expanded line of fatty nitrogen compounds.

Bassons Industries Corp., New York custom fabricator of plastics, has retained Pegasus International Corp., New York, as international representatives.

Johns-Manville has named the Thorpe Insulation Co., Houston, to handle contract installations of its insulating materials in the Gulf Coast area.

Meyercord Co. has named H. L. Barnebey, Columbus, Ohio, as licensing agent for use of its Chem-Dry process in printing and coating.

NEW LINES

Jones & Hunt, Inc., Gloucester, Mass., is now making low cost press molded sections which can be assembled at point of use to make corrosion resistant fiber glass tanks ranging from 50 to over 1,000 gal. capacity.

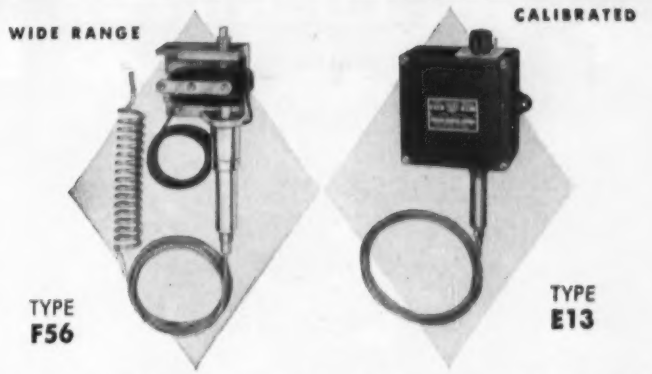
Coppus Engineering Corp., Worcester, Mass., has acquired from the McRae Corp., Glendale, Calif., exclusive manufacturing and sales rights to its patented automatic quick-closing latch-type valves and quick-opening piston valves.

Raymond Laboratories, Inc., cosmetic chemists of St. Paul, Minn., plan to enter the commercial chemical field making available from stock commercial quantities of sodium lauryl sulfate, quarternary ammonium compound, and thioglycolic acid and its salts.

United Cork Co., Kearny, N. J., has entered the styrene foam business. It has acquired from Badische Anilin & Soda-Fabrik of Ludwigshafen, Ger-

Improved Design **REMOTE BULB TEMPERATURE CONTROLS**

F56 / E13



The F56 and E13 are functionally similar controls. Type F56 is a wide range, uncalibrated, skeleton unit designed for use in ovens, incubators, and other applications where space or weight is a limiting factor. Type E13 is a narrow range, calibrated, enclosed unit intended for similar applications but under conditions where an enclosure and external adjustment knob and dial are desirable. Explosion proof unit, Type E98, is also available.

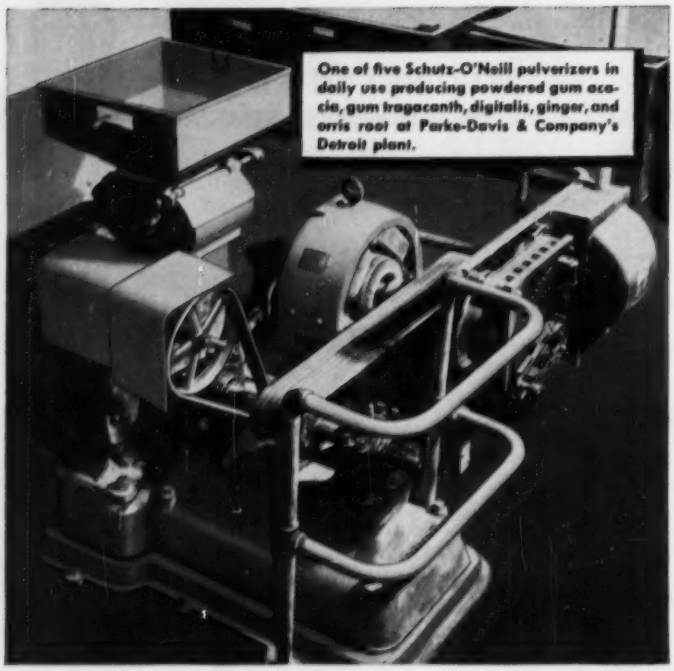
Temperature Ranges	F56 . . . up to maximum limits of −150° to +150°F, 70° to 370°F, or 100° to 650°F. E13 . . . 100° or 200° spans between −150° and +650°F limits.
Switch Ratings	15 or 20 amps at 115 or 230 volts AC. DC switches also available.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Adjustments	F56 . . . slotted range adjustment screw on top, uncalibrated settings. E13 . . . external knob and pointer, calibrated settings.
Electrical Connections	F56 . . . 12-inch lead wires attached directly to switch terminals. E13 . . . to internally located terminal block via conduit opening in enclosure.
Capillary Tube Length	6-foot standard length. Other lengths available.
Mounting	E13 . . . surface mounted in any position by means of dog ears. May be flush mounted. F56 . . . Surface mounted in any position by holes drilled in base of bracket. May be flush mounted.

UNITED ELECTRIC *manufactures a complete line of temperature, pressure, and vacuum controls. For additional data on the remote type temperature controls, including types F56 and E13, request* **Section 200** *of our* **new** *catalog.*

UE®

United Electric Controls COMPANY

84 SCHOOL STREET, WATERTOWN, MASS



One of five Schutz-O'Neill pulverizers in daily use producing powdered gum acacia, gum tragacanth, digitalis, ginger, and orris root at Parke-Davis & Company's Detroit plant.

SCHUTZ-O'NEILL PULVERIZERS

A 50-YEAR TRADITION

The name Parke-Davis & Company is known worldwide as a leading pharmaceutical manufacturer. For over fifty years Schutz-O'Neill pulverizers have played a dominant part in this well earned reputation in the production of highest quality products that meet the most rigid standards.

Manufacturers of food, chemical, drug and mineral products have depended on Schutz-O'Neill pulverizers for over 65 years. In all parts of the world Schutz-O'Neill pulverizers are in daily operation preparing materials ranging from microfine powdered sugar in the food industries, to borax in the mineral industries.

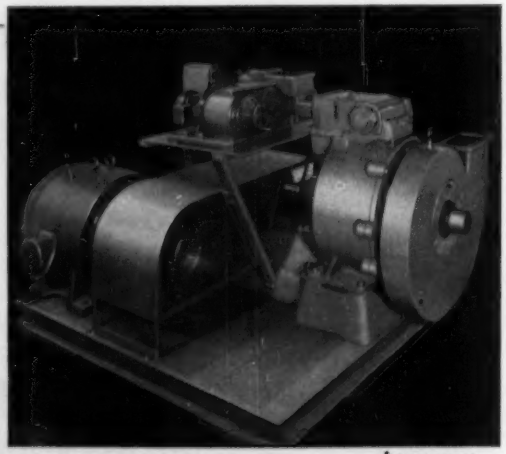
Versatility for production of medium-coarse, fine and microfine powders have made them the choice for milling superior powders from such materials as specialty grain fractions, cocoa powder, aspirin, saccharin, ultrafine diatomaceous earth, limestones and phosphates, urea melamine and phenolic plastic moulding powders, and herbs, barks, roots and seeds of all types.

One of six new SCHUTZ-O'NEILL SUPERFINE PULVERIZERS

now available in sizes ranging from 7½ to 125 horsepower with grinding chambers 12" to 28" in diameter.

SEND SCHUTZ-O'NEILL YOUR SIZE REDUCTION PROBLEMS

Our engineers will welcome working with you on your new product or help improve the milling operation of your present products. Give us your requirements and send a sample of feed material for a pilot plant test. There is no obligation.



ESTABLISHED 1893

SCHUTZ-O'NEILL COMPANY

301 PORTLAND AVENUE, MINNEAPOLIS, MINNESOTA

PULVERIZERS
GRANULATORS
ROLLER MILLS
AIR CLASSIFIERS
SIFTERS
HAMMERMILLS

many, a U. S. license for its process for manufacturing an expandable polystrene and molding the expanded material into finished articles.

NEW LOCATIONS

Nicolay Titlestad Corp. and Andrew M. Fairlie, Inc., have moved to 521 Fifth Ave., New York.

Union Oil Co. of California has transferred from Los Angeles to Philadelphia the headquarters for marketing operations in 39 eastern states.

C. N. Flagg & Co., which handles such installations as process and power piping, acetylene and oxygen plants, has moved to 48 Elm St., Meriden, Conn.

Farrell-Birmingham Co., Ansonia, Conn., has moved its Chicago office to 10725 South Western Ave.

International Nickel Co. has moved the Detroit technical section of its development and research division to 19842 James Couzens Highway.

General Electric Co.'s Carboloy department has moved its Pacific district offices to 2106 West Washington Blvd., Los Angeles.

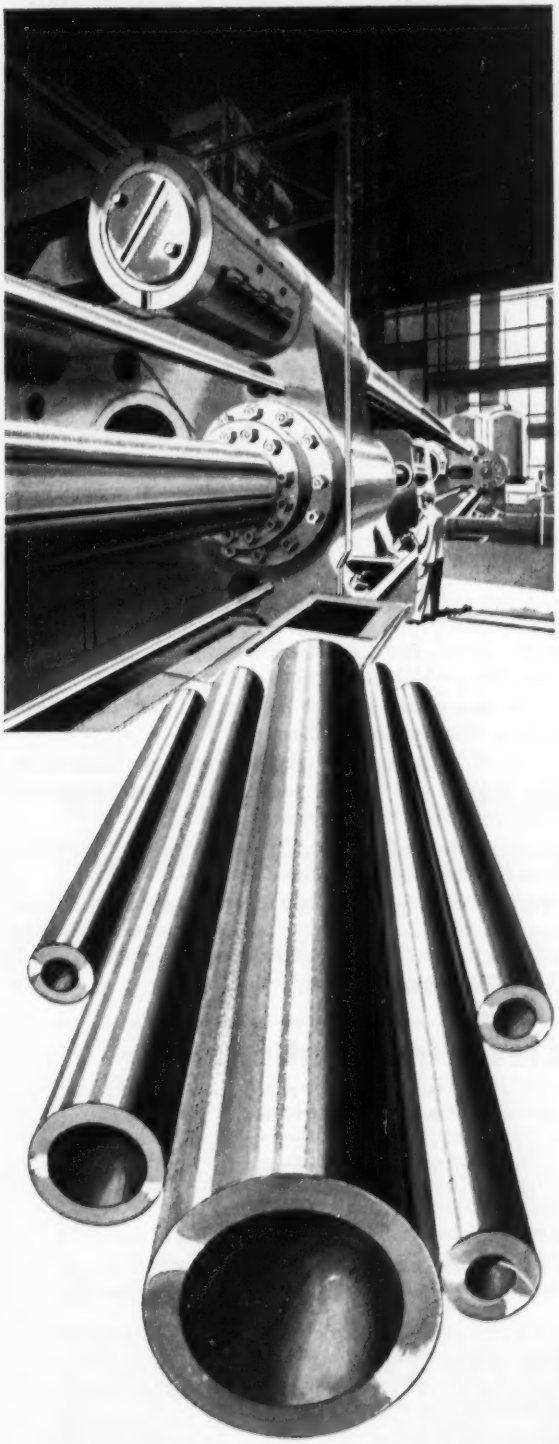
NEW NAMES

Esso Development Co. Ltd., London, has changed its name to Esso Research Ltd.

M. B. Rosevear Co., sales and engineering representatives for manufacturers of heating and control equipment, has changed its name to R. L. Faber & Associates. The company is moving to 1246 Broad St., Bloomfield, N. J.

Zonite Products Corp. has changed its name to Chemway Corp. It is building new main offices, laboratories and production facilities in Wayne Township, N. J., to replace present operations in New Brunswick, N. J.

NOW! from the world's largest horizontal steel extrusion press...



SEAMLESS

HEAVY WALL PIPE

from any ferrous alloy

Now heavy wall pipe can be extruded from any ferrous alloy – in lengths up to 50 feet or more, with O.D.'s from 4" to 22", and with virtually no restriction on wall thickness.

The giant Curtiss-Wright horizontal extrusion press, now operating at the Metals Processing Division, *moves* the metal instead of *removing* it, for pipe of maximum length – and strength.

If your application calls for higher heat, corrosion and/or abrasion resistance – in pipe of highest tensile and yield strengths – Metals Processing Division is geared to fill the requirement. Complete facilities for handling any ferrous alloy, including the stainless series, as well as titanium and other reactive metals, are available to the chemical, petroleum, power and other key industries.

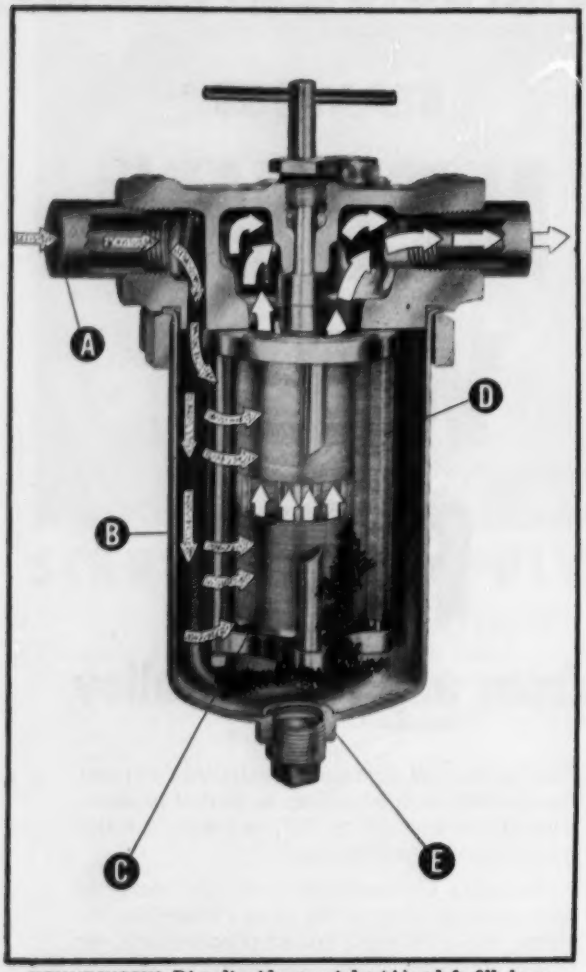
Take advantage of this new, aggressive facility for your pipe requirements. Write, wire or telephone for detailed information or engineering consultation today. Our field engineers are at your service.

METALS PROCESSING DIVISION

CURTISS-WRIGHT

CORPORATION • BUFFALO, NEW YORK

New! CUNO SUPER Auto-Klean Filter



HOW IT WORKS. Dirty liquid enters inlet (A) at left, fills housing (B) and flows through metal edge-type filter (C). Clean liquid rises through center of filter, leaves at right. Dirt combed out by cleaner blades (D) is removed through drain (E).

A 40-micron, self-cleaning filter for process liquids

...and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, micronic filtration at high flow rates and eliminates the need for replacement cartridges. Here's what SUPER Auto-Klean offers process industries:

1. *Micronic filtration* with a self-cleaning filter. Just turn handle to clean—continuously with motor drive or intermittently by hand.
2. *Eliminates cartridge changes.* Ends operating costs if you've been using cartridge filters.
3. *No pressure-drop build up.* An 8-in. long, 2¼-in. diameter cartridge handles 30 gpm of liquid at 50-centipoise viscosity with only 3-psi pressure drop—up to 75% more with a slightly higher pressure drop.
4. *Positive protection* against solid particles larger than 40 microns (actually 0.0015-in.). Can't rupture or channel.
5. *Much smaller* than replaceable-cartridge-type filters of equal capacity, you save on lower initial costs, lower installation costs, lower space requirements than for cartridge units. You get high capacity in a small package.
6. *No duplex units needed.* Handles full flow all the time with no interruptions for cleaning.
7. *SUPER Auto-Klean* fits existing Cuno Auto-Klean housings. You can easily replace most 2¼-in. diameter cartridges with SUPER Auto-Klean for finer filtration.
8. *SUPER Auto-Klean* is available in all-steel or type-316-stainless-steel construction with Teflon seal.

WRITE TODAY for your copy of SUPER Auto-Klean Catalog SAK-057 or discuss your specific process application with our engineers. Cuno Engineering Corporation, 3-7 South Vine Street, Meriden, Conn. 5.10

Typical SUPER Auto-Klean installations

1. 50 gpm of organic solution, viscosity 100 to 130 cps at 80°C operating temperature and 125-psi operating pressure—40-micron filtration.
2. 1.2 gpm of polyethylene, viscosity 50,000 cps at 340°F, operating pressure of 2,000 psi and pressure drop of 800 to 900 psi—40-micron filtration.
3. 10 gpm of resin, 2,000 SSU at 500°F and 100-psi operating pressure—40-micron filtration.
4. 10 gpm of printing ink—40-micron filtration.
5. 20 gpm of coating liquid—40-micron filtration.
6. Phenolic water at 125-psi operating pressure on pumps—40-micron filtration.
7. 150 gpm of wax—40-micron filtration.

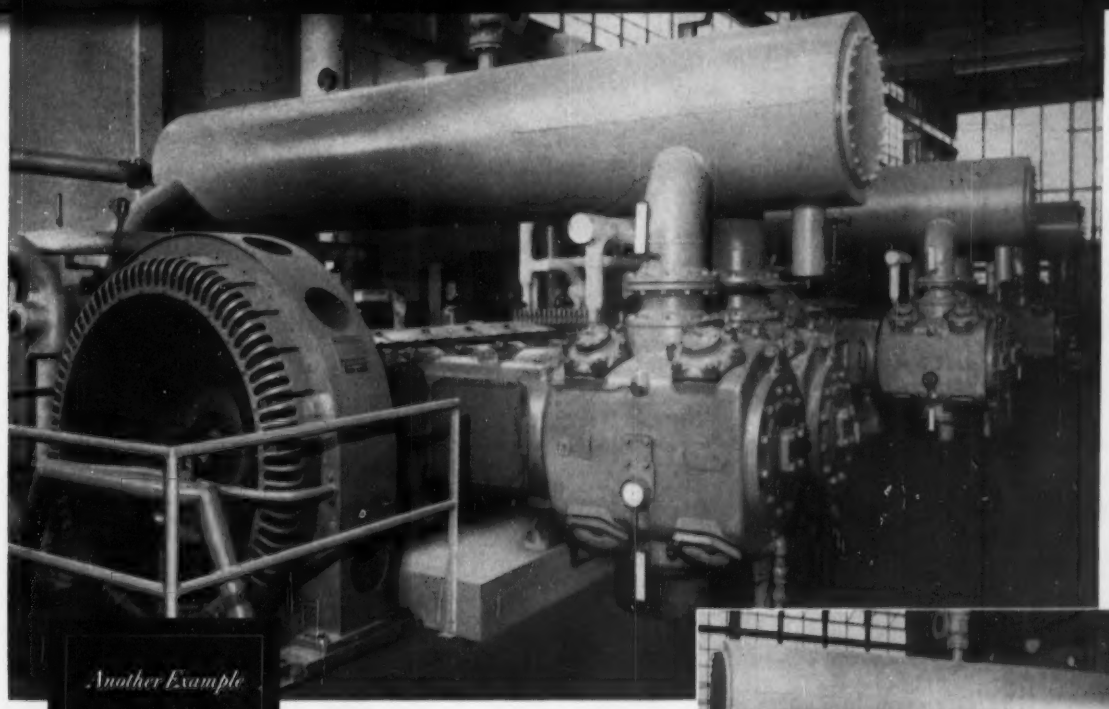
Ideal for in-line installation before pre-coat filters.

CUNO

ENGINEERED FILTRATION

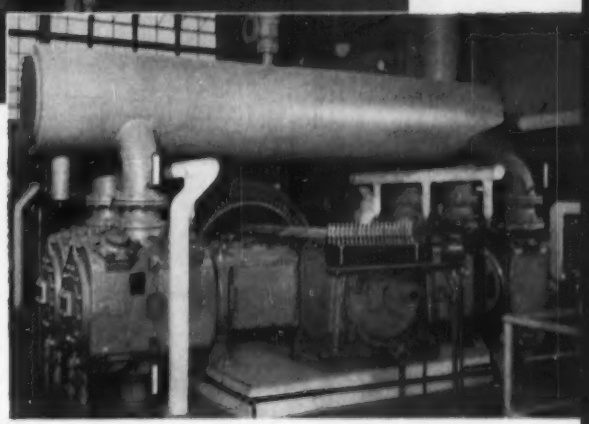
Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)



Another Example of Efficient Power at Lower Cost

At General Electric's Appliance Park Plant, three Cooper-Bessemer 1000 hp FM-5 air compressors play a part in supplying industrial air from a central location, for many and varied air services.



Close-up of one of the motor-driven Cooper-Bessemer units.

AIR...from Cooper-Bessemer Compressors for modern production at Appliance Park

• At General Electric's new Appliance Park Plant in Louisville, where these Cooper-Bessemer 1000 hp air compressors are at work, they've concentrated the manufacture of various appliance lines in this one giant plant. The object is highest efficiency in quality production at the lowest manufacturing cost.

The Cooper-Bessemer units, meeting all of the many and varied compressed air needs, fit in ideally with this policy of concentration, efficiency and minimum cost. Installed in a centrally located building, these modern two-stage, opposed balance compressors provide a dependable source of air, yet occupy minimum area. And, being well balanced, they require less foundation than was possible with older type machines.

If your plans call for compressed air on a long-term basis, find out about the extra advantages you'll get with Cooper-Bessemer. They range from 100 to 5,000 horsepower; save space, housing installation and piping costs . . . without sacrificing flexibility, ruggedness or accessibility.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Chicago, Ill. • Houston, Dallas, Greggton, Pampa and Odessa, Texas • Washington, D. C. Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. Caracas, Venezuela • COOPER-BESSEMER OF CANADA, LTD., Edmonton and Calgary, Alberta, Canada.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

A GOOD DOSE OF INSPIRATION NEVER HURT A CONSTRUCTION PROJECT

The quality of inspiration is of vital importance to the builder. Here at PROCON our men are well imbued with it. But, to this creative sense, we add those essential qualities of broad experience and sound technical knowledge so necessary for the satisfactory completion of any project, on time, and to every specification.

It is this combination of skills that makes us confident PROCON can provide to the fullest measure, reliable, efficient service in the planning, engineering and construction of your refinery, petrochemical or chemical plant. We are proving this, the world around, day after day.

PROCON *Incorporated*

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PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
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WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

Using Salt Efficiently

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt

How to Find the Strength of Salt Brines—Accurately

In most of today's plants, the type of hydrometer called a Salometer can generally be used to measure the strength of salt brines most accurately. This device (similar in principle to the hydrometer which checks the condition of your car's battery) is convenient to use—and its scale permits fast calculations for a variety of plant needs. The Salometer scale reads from 0° in pure water to 100° in saturated brine, with each degree representing a percentage of fully saturated brine.

Using the Salometer with maximum accuracy, however, isn't just a matter of reading the scale. A number of simple precautions must also be taken to make sure the Salometer records correct brine strength. Here they are:

1. Check the temperature of the brine. Since most Salometers are calibrated for reading at 60° F., brine temperature should be kept at this level during testing. When other brine temperatures are encountered, it is necessary to use the following table of simple correction factors. These will help provide a completely accurate measurement of brine strength.

APPROXIMATE CORRECTION IN SALOMETER DEGREES

Observed Salometer reading	Subtract per degree below 60° F.	Add per degree above 60° F.
0 to 10	0.049	0.060
11 to 20	0.064	0.082
21 to 30	0.077	0.094
31 to 40	0.087	0.103
41 to 50	0.095	0.112
51 to 60	0.102	0.118
61 to 70	0.107	0.123
71 to 80	0.112	0.128
81 to 90	0.116	0.131
91 to 100	0.120	0.134

For measuring cold brines, such as those used in meat-packing plants, special 38° F. Salometers may be used. Special temperature-correction factors are available when using this type of Salometer to test brines above or below 38° F.

2. Brine should be tested only in a straight-walled cylinder made of clear glass—set on a level surface. Any moisture that collects on the outside of the cylinder should be wiped off before testing procedures start.

3. Salometer stem must be thoroughly dry, clean, and free from grease or caked salt crystals. Also, the Salometer should not touch the sides of the cylinder when readings are taken. It should be read with the stem in a vertical position.

4. Check new Salometers by placing them first in clear water; reading should be 0° S. Then empty the cylinder, rinse with a saturated salt solution, and refill with fully saturated brine; reading should be 100° S. Both water and brine should be at 60° F.

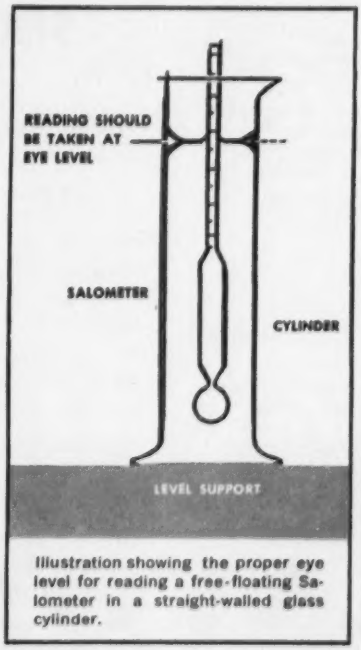


Illustration showing the proper eye level for reading a free-floating Salometer in a straight-walled glass cylinder.

5. Correct reading technique. Brine tends to rise along the sides of a glass cylinder, forming a concave surface known as a meniscus. For correct reading, the eye should be brought to a point level with the *bottom* of this meniscus. Errors of two or three degrees are possible if reading is taken at the point where the brine has risen along the sides of the cylinder.

Special Salometers. In the canning industry, where brine is used for quality grading, a different type of Salometer is often used. It's graduated on a scale where 100° S. represents brine containing 25% salt, instead of the normal 26.395%. Special hydrometers may also be used in the tanning or chemical industries. But the same procedures outlined here must always be followed when brine is to be tested—no matter what type of hydrometer a plant uses.

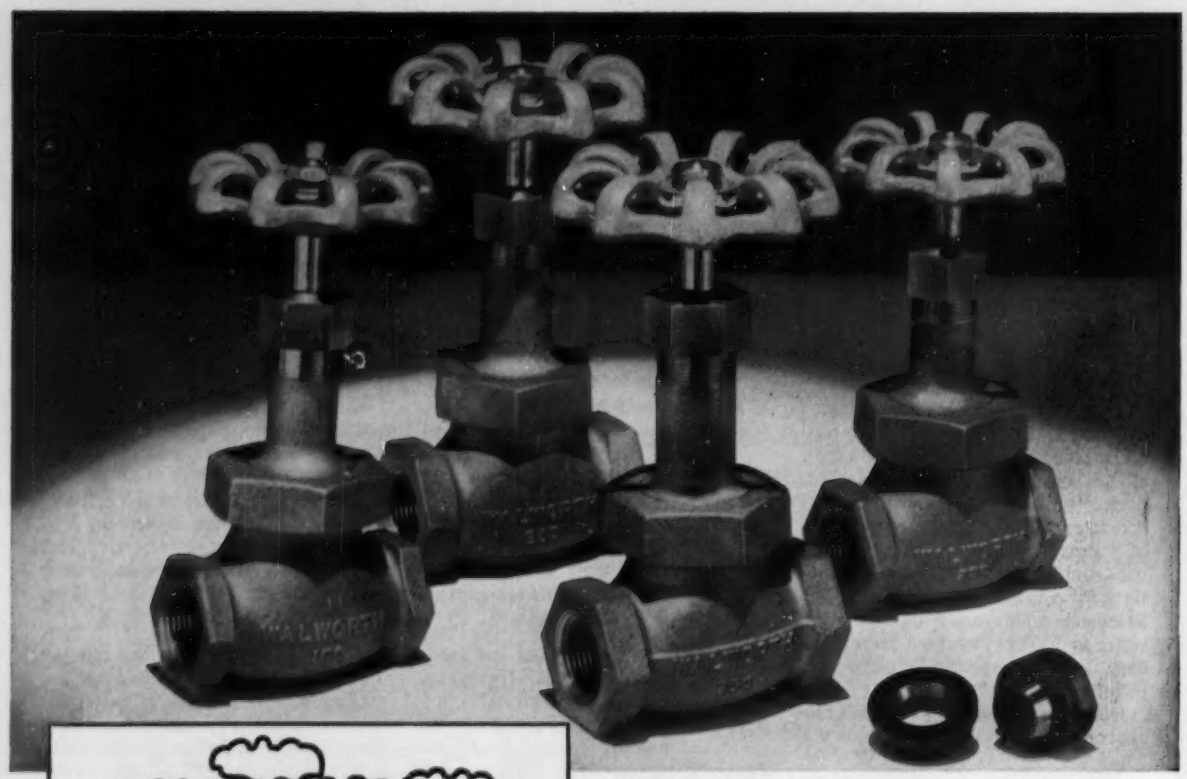
TECHNICAL SERVICE WITH YOUR SALT

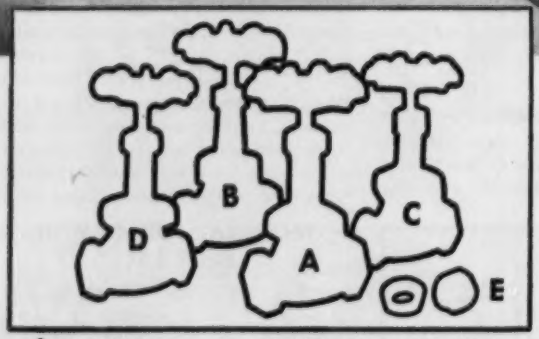
Through skilled and experienced "Salt Specialists," International can help you get greater efficiency and economy from the salt or brine you use. International produces both Sterling Evaporated and Sterling Rock Salt in all types and sizes. And we also make automatic dissolvers in metal or plastic for both kinds of salt. So we can recommend the type and size of salt most perfectly suited to your needs.

If you'd like help on any problem concerning salt or brine—or further information on testing brine strength—contact your nearest International sales office.

International Salt Co., Scranton, Pa.
Sales Offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, Ohio; Cleveland, Ohio; Philadelphia, Pa.; Pittsburgh, Pa.; Richmond, Va.

FOR INDUSTRY, FARM, AND THE HOME—
STERLING SALT
PRODUCT OF INTERNATIONAL SALT CO., INC.





A — No. 225P.....350 WSP 550F, 1000 WOG
B — No. 260P.....300 WSP 550F, 600 WOG
C — No. 245P.....200 WSP 550F, 400 WOG
D — No. 237P.....150 WSP 500F, 300 WOG
E — "500 Brinell" Stainless Steel Plug Type Seat and Disc

Walworth offers four lines of Bronze Globe Valves with stainless steel, plug-type seats and discs. Advantages of these valves include:

• **Stainless Steel Plug-Type Seats and Discs,** heat-treated to a minimum of 500 Brinell hardness reduces wire-drawing to a minimum. Seats and Discs are machined and fitted simultaneously, assuring perfect mating.

• **Deep Stuffing Boxes with Glands** are fitted with reinforced, molded packing. Valves can be repacked under pressure when fully opened.

For Longer Bronze Valve Life . . .

"500 BRINELL" PLUG-TYPE STAINLESS STEEL SEATS AND DISCS

150 lb. 200 lb. 300 lb. 350 lb.

• **Oversize Stems,** made of high tensile strength silicon-bronze, assure long life.

• **Rugged Body Hexes,** are flat on top; do not interfere with wrench gripping body-to-bonnet union ring connection.

• **Bodies,** made of Composition M bronze (ASTM B61), have ample wall thickness to provide high safety factor.

• **Patented Handwheels** are air-cooled and designed with a "finger-fit grip." Makes turning easy even when wearing greasy gloves.

• **Identification Plates** secured by lock-washer under stem nut, show Figure Number of valves and make re-ordering sure and easy.

FOR COMPLETE INFORMATION, SEE YOUR WALWORTH DISTRIBUTOR OR WRITE FOR ILLUSTRATED CIRCULAR

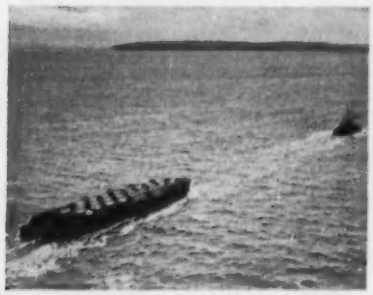
WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. · CONOFLOW CORPORATION · M & H VALVE & FITTINGS CO. · SOUTHWEST FABRICATING & WELDING CO., INC. · WALWORTH COMPANY OF CANADA, LTD.

BRIEFS for buyers of

Caustic Soda
Inert Lubricants
Caustic Potash
Carbonate of Potash



Caustic soda by barge might save you money

Nearby navigable water could make a big difference in the amount you pay for caustic soda and other heavy chemicals.

Some of our customers save up to tens of thousands of dollars a year because they receive more cheaply by barge.

The single barge shown here, for example, is on its way to a pulp mill with 11 tank cars of chemicals above deck, 1000 tons of liquid caustic soda below.

Your Hooker salesman can help you discover whether you can receive caustic and/or other Hooker chemicals more cheaply by barge from one of our plants or stock points.

Inert, high-density lubricants

Liquid oxygen and hydrogen peroxide —explosive fuels for rockets and guided missiles—have no effect whatsoever on Fluorolube® oils and greases.

Fluorolubes are inert to most other reactive materials, including concentrated nitric acid.

Their densities are unusually high for organic compounds—from 1.8 gm/cc to 2.0 gm/cc. Yet, Fluorolubes wet metallic surfaces readily and thoroughly.

Thermally stable up to 300°C., these Hooker polymers of trifluorovinyl chloride won't burn at any temperature. They're non-toxic.

Because of these unique properties Fluorolubes show potential for many applications; as lubricants for ultra-precision instruments such as floated gyro units, for valve, pump, and bearing assemblies, for vacuum pumps; and as impregnants for gaskets and packing in highly corrosive service.

There are seven Fluorolubes, ranging from light oils to heavy greases. You can get technical data on all seven by checking the coupon.

Caustic potash — why the package is important

Expose it to air and solid caustic potash soaks up moisture and carbon dioxide swiftly.

Result: weaker, chemically damaged caustic potash that can slow down your processing.

To help you avoid such damage, and to protect the inherent purity of *Nialk*® caustic potash, we make our own shipping containers to our own rigid specifications.

Result: You always get Nialk caustic potash in the form and strength you want.

You can get *Nialk* caustic potash through all Hooker sales outlets, in these forms:

85% (low iron) and 90% solid, walnut, flake, granulated, broken, crushed and powdered. Flake is available in *low chloride* grade also.

45% to 50% liquid solutions in standard and *low chloride* grades.

If you'd like information on the physical properties of Nialk caustic potash, on shipping, etc., check coupon for technical data sheet and bulletin.

Carbonate of potash

Do you use both caustic potash and carbonate of potash? You might find that a single source for both offers faster, more economical supply. You can get both from Hooker.

For technical data on Hooker chemicals discussed on this page, check here:

- ☐ Caustic Soda, 50% & 73%
- ☐ Caustic Soda, solid and flake
- ☐ Caustic Potash
- ☐ Carbonate of Potash
- ☐ Fluorolubes, oils and greases

Keep your file up-to-date with technical data sheets on these other Hooker chemicals:

- ☐ Aluminum Chloride
- ☐ Lauryl Chloride
- ☐ Monochloroacetic Acid
- ☐ Muriatic Acid
- ☐ Sodium Benzoate
- ☐ Sodium Sulfhydrate
- ☐ Sodium Sulfide

Clip and mail to us with your name, title, company address. *When requesting samples, please use your business letterhead to help speed delivery.*

HOOKER CHEMICALS PLASTICS

6-1117

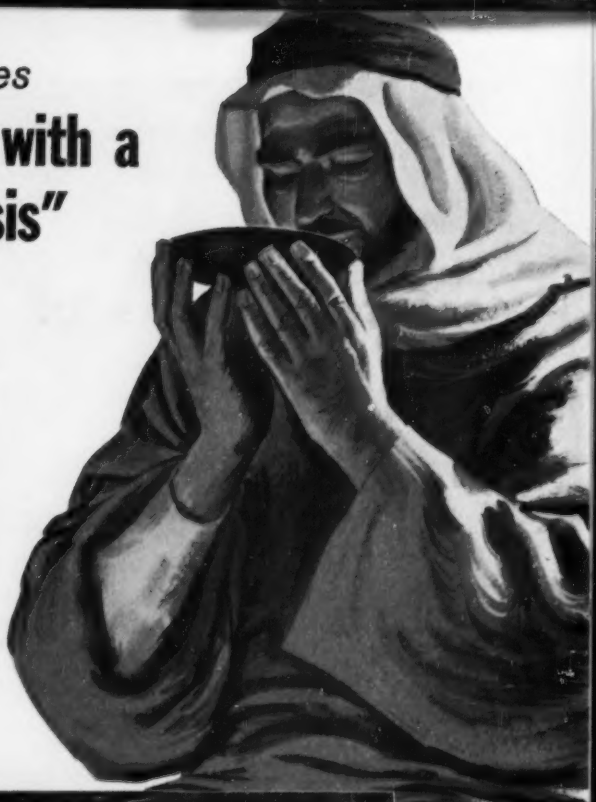
HOOKER ELECTROCHEMICAL COMPANY

407 Forty-seventh St., Niagara Falls, N. Y.

Niagara Falls • Tacoma • Montague, Mich. • New York • Chicago • Los Angeles

In Saudi Arabia and in 21 other countries

it pays to produce pure water with a Cleaver-Brooks "mechanical oasis"



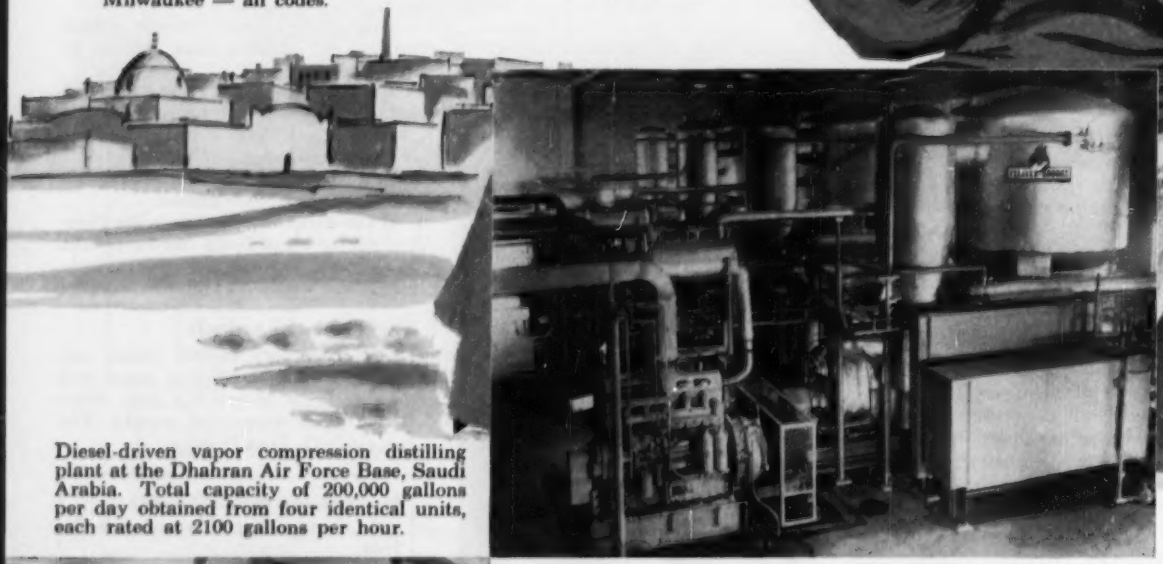
Vapor compression units deliver potable water for as little as $1.25 per 1000 gallons

Raw water source is brackish well water feeding one of the world's largest vapor compression evaporators installed at the Dhahran Air Force Base in Saudi Arabia. At the other end of the system — tasty, palatable drinking water, far exceeding USPH standards.

This performance is being repeated daily — all over the world . . . wherever fresh water is scarce and costly. Studies show operating costs are extremely low. Three hundred gallons of fresh water, for example, are produced for every pound of Diesel fuel.

Any raw water source will do. Sea water, brackish, contaminated pools, streams are typical. You eliminate long pipelines, trucking, barging, plus chances of delivery failures.

Regardless of your pure water requirements — it will pay you to investigate Cleaver-Brooks evaporation equipment for commercial, industrial, municipal and marine applications. Write: Cleaver-Brooks Company, Special Products Division, 345 E. Keefe Ave. Milwaukee 12, Wisconsin U.S.A. Cable Address: CLEBRO — Milwaukee — all codes.

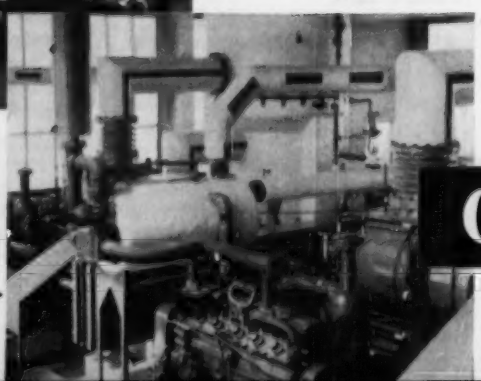


Diesel-driven vapor compression distilling plant at the Dhahran Air Force Base, Saudi Arabia. Total capacity of 200,000 gallons per day obtained from four identical units, each rated at 2100 gallons per hour.

CLEAVER-BROOKS EVAPORATORS ARE IN SERVICE 'ROUND THE WORLD.

Aden	Egypt	Peru
Australia	French West Africa	Paraguay
Bahama Islands	Gibraltar	South Africa
Bahrein	Hawaii	Spain
Bermuda	Marshall Islands	Saudi Arabia
Belgium	Nauru and Ocean Islands	United States
Canada		Virgin Islands
Ecuador		Wake Island

TODAY — Cleaver-Brooks evaporation equipment users include public water utilities, pharmaceutical houses, beverage bottlers, distillers, oil companies and divisions of our armed forces. There's a choice of sizes from 40 gph to 2100 gph in single units — larger units in multiple installations.



▲ This 1200 gallons-per-hour sea water distilling plant is located at Gibraltar on the Mediterranean. It is electrically driven.

Two 1200 gallons-per-hour vapor compression, diesel-driven plants located in Port Etienne, French West Africa. ▶

Cleaver Brooks®

25th YEAR

BUILDERS OF EQUIPMENT FOR THE GENERATION AND UTILIZATION OF HEAT AND POWER

Concentrated Heat for Industry*

Scientists and engineers have done a tremendous amount of work, over the past 10 years, with new techniques in burning fuels. Most of their work has been aimed at the goal of making airplanes and rockets fly faster. Now, as this illustration shows, industry is picking up some of the techniques for its own use.

and smaller area can pay off in the operations of several industries. But as it stands, a jet turbine's too rich for a pi... bine's f...

*from BUSINESS WEEK of January 22, 1955

...built around *Carpenter* Stainless Tubing for Long Life!

This unique type compact heat exchanger has found ready acceptance as a highly efficient and dependable source of hot air or gas at pressures up to 300 psi and temperatures to 1200°F. Carpenter Stainless Tubing met every requirement of the manufacturer—superior strength at high pressures and temperatures, easy fabrication, uniform expansion, oxidation resistance and long, maintenance-free performance. That's why Carpenter Stainless Tubing is used exclusively for the straight tube and coiled fin-tube bundles, both shown at right partially assembled.

Any heat transfer equipment worth building or using is worth Carpenter quality. It costs no more . . . because all full-finished Carpenter Stainless Tubing meets the high and uniform quality requirements for heat exchanger applications. And you are sure of getting the highest possible degree of perfection in Carpenter tubing because it must pass the most exacting and thorough non-destructive test ever applied to stainless tubing.

Call your nearest Carpenter Distributor or Branch Office to give your equipment the benefit of better-than-ever Carpenter Stainless Tubing.

MEMBER

The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Export Dept.: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

Carpenter

Stainless Tubing & Pipe

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N. Y.

IS THIS **YOU?**

They have such refined and delicate palates
that they can discover no one worthy of their ballots,
and then when someone terrible gets elected,
they say, "There, that's just what I expected!"
—Ogden Nash

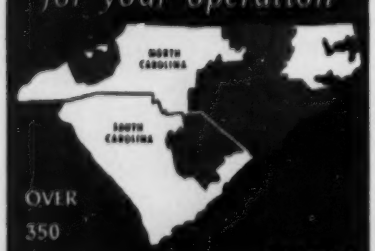
GET READY, by being registered.
GET SET, by knowing what you're voting for. Then—GO VOTE!

Published as a public service in cooperation with The Advertising Council

WHERE TO BUY

Featuring additional Equipment Materials, Supplies and Service for the Process Industries

THE RIGHT LOCATION *for your operation*



OVER 350 COMMUNITIES TO CHOOSE FROM

(Address J. P. Vecker, Vice President Area Development Dept.

Carolina Power & Light Co.
RALEIGH NORTH CAROLINA

STOP CORROSION with Acme-Fisher RUBBER LININGS and COVERING

Acme-Fisher corrosion-preventing rubber lining and covering of Hypalon and other materials can be applied to almost anything. You can depend on getting the correct formulation to provide the highest degree of protection and at the correct price.

Write for price list on rubber lined pipe and fittings. For special jobs write, wire or call for quotation.

ACME-FISHER DIVISION BROADWAY RUBBER CORP.

TANK-O-METER FOR MEASURING TANK CONTENTS ANY DISTANCE AWAY ANY LIQUID

Uehling INSTRUMENT CO.
491 GETTY AVENUE, PATERSON, N. J.

WEIGH MATERIALS WHILE CONVEYING with the MERRICK WEIGHTOMETER

MERRICK SCALE MFG. CO.
171 SUMMER ST., PASSAIC, N. J.

Make it a HABIT . . . to check this page— EACH ISSUE

THIS WHERE TO BUY SECTION supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation in the process industries.

CHEMICAL ENGINEERING

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

RATES

DISPLAYED

The advertising rate is $23.45 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.
Subject to Agency Commission.

UNDISPLAYED

$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Position Wanted ads are ½ of above rate.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions. Not subject to Agency Commission.

Send NEW ADS or Inquiries to Classified Advertising Division of CHEMICAL ENGINEERING, P. O. Box 12, N. Y. 36, N. Y.

A CONFIDENTIAL SERVICE *for...*

ENGINEERS
SCIENTISTS
800 Client Companies
Many Fee-Paid Opportunities in
New York, New Jersey, Connecticut

SUBURBAN
EMPLOYMENT AGENCY, INC.
102 Main St., White Plains, N. Y.

Offices in
Stamford, Conn. and N. Y. C.

DIVISION MANAGER

Moderate size, rapidly growing manufacturer with nationwide distribution starting new division. High polymer experience plus administrative potential helpful. Starting salary $10,000-12,000. Co. pays agency fee & relocation costs.

Monarch Personnel
28 E. Jackson Blvd.
Chicago 4, Ill.

CHEMICAL ENGINEERS

An active, confidential service!
Interview at your convenience.
Call, write or wire
GLADYS HUNTING (Consultant)
DRAKE PERSONNEL, INC.
220 So. State St. Rm. 628 Chicago 4, Ill.
HArrison 7-8600

Linde
and
LOW TEMPERATURE ENGINEERING

We have unlimited opportunities for CHEMICAL ENGINEERS in:

- distillation
- heat transfer
- thermodynamics
- fluid flow
- stress analysis
- equipment design
- instrumentation and controls
- pilot plant design and operation
- process engineering
- fabricating techniques

These projects are associated with the production and distribution of oxygen, nitrogen and argon as low temperature liquid or gases.

LOCATION: Our Tonawanda Laboratories in suburban Buffalo, New York—our largest research and development facilities.
B.S., M.S., Ph.D. graduates with up to five years experience are invited to investigate.

LINDE AIR PRODUCTS COMPANY
a Division of
UNION CARBIDE AND CARBON CORPORATION
Send resumes and approximate academic standing to:
Mr. P. I. EMCH, P. O. Box 44
Tonawanda, New York Refer to ad: CEG-L

REPLIES (Box No.): Address to office nearest you c/o this publication, Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITIONS VACANT

Graduate Engineers. Preferably chemical for both headquarters consulting and field sales work. For sales, should have 3 or more years successful record. For consulting, young men preferred so that our business can be taught and they can move up. Write P-9197, Chemical Engineering.

Assistant Chief Engineer age limit 45. Must be graduate mechanical, chemical or civil engineer with natural mechanical ability, excellent practical and supervisory and some construction experience, for charge under chief engineer of all shops, foundry, mobile equipment including loading, marine, railway and construction; maintenance and repair of all types of equipment; 7200 KVA diesel generating plant. Mine and mill 2600 tons/day. Flotation Mill Copper. Salary open. Foreign. With initial letter send full experience, references, age, marital status, number and age of children. Reply; Cyprus Mines Corporation, 523 West Sixth Street, Los Angeles 14, California.

Patent Opportunity. Work closely with chemical, metallurgical research personnel; screen developments for patentability. Prepare, prosecute less important applications; work in liaison outside counsel. N.Y.C. To $15,000. Philbrick Patent Personnel Agency, Box 337, Middletown, N. Y.

Metallurgists: Company engaged in basic process and Pyrometallurgy requires several men for production development and quality control who have some experience in one or more of the following: smelting and refining, steelmaking, or electric furnace operation. Excellent opportunities for qualified men. Hospitalization, insurance and pension plan provided by company. Plants located Midwest, North and South. All replies held strictly confidential. Submit detailed resume to Box #368 Niagara Falls, N. Y.

POSITIONS VACANT

Chemists Chemical Engineers, experienced in Chemistry and Metallurgy related to heavy and non-ferrous metals, particularly nickel and cobalt. Unusual opportunity in our Cuban operations, employee benefits, low taxes. Write P-2037, Chemical Engineering.

Asst. General Plant Superintendent, 5-10 years experience in production operations related to heavy and non-ferrous metals, particularly nickel and cobalt, with a degree in Chemical Engineering or Metallurgy. Unusual opportunity in our Cuban operations, employee benefits, low taxes. Write P-2040, Chemical Engineering.

Researcher in Sugar Wastes Wanted in Washington—Young chemical engineer or chemist well familiar with the field of sugar chemistry and use of sugar cane wastes. Well paid, challenging research project with future for young, well-trained man. Write with very complete details in confidence to P-1765, Chemical Engineering.

SELLING OPPORTUNITY OFFERED

Manufacturer of Heat-Transfer apparatus & pressure vessels required additional sales representation in East. Contacts in Chemical Plants, Marine, oil refineries and power plants desirable. RW-1952, Chemical Engineering.

EMPLOYMENT SERVICES

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 46 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 553 Brisbane Bldg., Buffalo 3, N. Y.

Salaried Personnel, $5,000-$35,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection, under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L. P. O. Box 674, Manchester, Vermont.

POSITION WANTED

Chemical Engineer. Grad. Europe and U.S.A. now asst. direction, age 30, broad background, wish to emigrate U.S.A. or Canada for design, research or academic position. Four languages. PW 1946, Chemical Engineering.

ENGINEER, PLASTICS

Exceptional opportunity in Research and Development work with country's fastest growing structural plastics manufacturer for Chemical Engineer with 1-5 years experience in reinforced plastics who can accept considerable responsibility.

Ideal living conditions, excellent salary and liberal hospitalization, life insurance and pension plan.

Send complete resume including salary requirements to: R. H. Gammon, Manager, Salaried Employment, Brunswick-Balke-Collender Co., Marion, Va.

TECHNICAL SALES

Graduate engineers for technical sales or technical service with two or more years experience — not necessarily in sales. Training in our polyethylene plastics laboratory with commercial size processing equipment. Field work with firms engaged in the molding and extrusion of polyethylene.

This is an exciting, fast growing field, where excellent opportunities exist for future advancement. Please write giving complete resume of education, experience and salary requirements to:

Spencer Chemical Company
500 Dwight Bld.
Kansas City, Mo.
Attn: Personnel Manager

SENIOR ENGINEER

Experienced in design and construction of high pressure equipment, such as Pumps, Compressors, Vessels, Pilot Plants, etc. Estimating experience desirable but not necessary. Salary open. Give full particulars in first reply.

AMERICAN INSTRUMENT CO.
8030 GEORGIA AVE.
SILVER SPRING, MD.
In Metropolitan Washington, D .C.

PROCESS DESIGN ENGINEERS

Permanent responsible positions with opportunity for high calibre men in Engineering Department of large Gulf Coast chemical manufacturing plant. Applicants should have the following qualifications:

1. B.S. or advanced degree in chemical engineering.
2. Minimum of three years experience in process design calculations, pilot plant operations or production trouble shooting—preferably in organic plants.
3. Interest in detailed calculations and mechanical-chemical interpretation into practical designs.
4. Interest in chemical engineering as a profession.
5. Ability to work with others in a team.

Positions are in Process Design Section for work on new plants and additions to existing plants. Work includes translation of pilot plant processes into full scale plant design, design calculations on distillation, heat transfer, mass transfer, fluid flow, and associated work necessary to prepare flow sheets (no drafting). Processes are both organic and inorganic. Some field data and production equipment performance evaluation involved. Small electronic computer to be available in this work. Assignments will allow for full recognition of individual's ability, with commensurate salary.

Replies held in strictest confidence, all will be answered. Please send complete resume, including education, experience, and salary expected to Mr. D. M. Duguid, Technical Employment Manager.

Texas Division

The Dow Chemical Company

Freeport, Texas

IMPORTANT TEACHING POSITIONS OPEN IN ISRAEL

Technion, Israel Institute of Technology, in Haifa, Israel, proposes to appoint:

Professor of Soil Engineering
Professor of Industrial Management and Production Engineering
Professor of Chemical Engineering
Professor of Mathematics
Professor of Psysical Chemistry
Professor of General and Inorganic Chemistry

Applicants should have first-rate professional and academic qualifications, be willing to integrate themselves into the life of the country and, in due course, to teach in Hebrew.

Applications with full details should be sent in duplicate, for transmission to Haifa, to the:

AMERICAN TECHNION SOCIETY
1000 Fifth Avenue New York 28, N. Y.

HELP WANTED

Metallurgists: Company engaged in basic process and pyrometallurgy requires several men for Production, Development and Quality Control who have some experience in one or more of the following: Smelting and Refining, Steelmaking, or Electric Furnace Operation. Excellent opportunities for qualified men. Hospitalization, insurance and pension plan provided by Company. Plants located midwest, north and south. All replies held strictly confidential. Submit detailed resume to

P-1549, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

Procter & Gamble needs CHEMICAL ENGINEERS

(Graduated within last 10 Years)

- Permanent positions in Chemical Process Equipment Design and Application and other Engineering Fields.
- Salaries commensurate with education and industrial experience.
- Opportunities to grow with a leading chemical processing company—rated as one of the nation's three best-managed companies by the American Institute of Management.

For application form and further information write

Mr. J. E. Gale
Head of Employment
Engineering Division
The Procter & Gamble Company
Cincinnati 17, Ohio

SALES ENGINEER

Are you interested in a sales engineering position in the field of instrumentation and automation? We are looking for engineering graduates, preferably Chemical or Electrical, 25 to 33 years of age for New York, Buffalo, Charleston, West Virginia, Philadelphia, Memphis, Detroit, Chicago, Tulsa, Los Angeles. Must be willing to relocate and travel adjacent territory.

Compensation on straight salary basis, all expenses paid and car furnished with liberal fringe benefits. Sales experience desirable, but not necessary as we provide Klein Sales Aptitude Test at our expense.

Successful applicants will receive thorough training course at our factory, Foxboro, Massachusetts, before being assigned to branch office.

If you are interested in a real opportunity with a progressive organization, please write:

J. J. Burnett,

THE FOXBORO COMPANY,
4546 Oakton Street, Skokie, Illinois,

sending resume of education and past experience.

CHEMICAL ENGINEERS for APPLIED RESEARCH

Battelle's expanding research program for industry is creating new career positions for capable chemical engineers in the following fields:

Pilot Plant Operation
Heat Transfer and Thermodynamics
Process Development
Reactor Engineering
Extractive Metallurgy
Minerals Beneficiation
Electrochemical Engineering
Ceramics

These positions offer out-of-the ordinary merit promotional opportunities in a stable, progressive organization which has enjoyed a threefold increase during the past ten years. For technical application form, write to

TECHNICAL PERSONNEL MANAGER
BATTELLE INSTITUTE
505 King Avenue Columbus 1, Ohio

CHEMICAL ENGINEERS

Ages 24-36—A long established and rapidly growing chemical company is seeking chemical engineers for positions in its Production and Development areas. Position requires a minimum of 2 years experience in chemical process study or process trouble shooting plus a good academic background. Openings exist in medium size plants located in Western New York State and Western Pennsylvania.

P-1872, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

WANTED TECHNICAL EDITORS

To provide for its continued growth Chemical Week is seeking two additional assistant editors — preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

PERSONNEL DIRECTOR
McGRAW-HILL PUBLISHING CO.
330 W. 42ND ST.
NEW YORK 36, N. Y.

PROJECT & PROCESS ENGINEERS

Our Company is committed to a five-year expansion program in chemicals and plastics which will afford outstanding advancement opportunities. Even now, we are building two plants—one in the East and one in the West—to manufacture the new low pressure type polyethylene. We have several positions open for Chemical Engineers qualified in either Project Engineering or Process Engineering. We have many interesting possibilities to offer and want to hear from you. Please address all replies to:

Koppers Company, Inc.
Chemical Division
Development Laboratory
P. O. Box 65
Monaca, Pa.

EMPLOYMENT PROBLEM?

When you are in need of specialized men for specialized jobs, contact them through an *employment ad* in a McGraw-Hill Publication.

Management, Engineering, Production, Maintenance, Selling . . . these represent broadly the principal functions in business and industry. And it is principally to the men and executives who fill key jobs in these important divisions that McGraw-Hill publications are directed.

McGraw-Hill Domestic Publications

AMERICAN MACHINIST
AVIATION WEEK
BUS TRANSPORTATION
BUSINESS WEEK
CHEMICAL ENGINEERING
CHEMICAL WEEK
COAL AGE
CONTROL ENGINEERING
CONSTRUCTION METHODS AND EQUIPMENT
ELECTRICAL CONSTRUCTION AND MAINTENANCE
ELECTRICAL MERCHANDISING
ELECTRICAL WHOLESALING
ELECTRICAL WORLD
ELECTRONICS
ENGINEERING AND MINING JOURNAL
ENGINEERING NEWS-RECORD
FACTORY MANAGEMENT AND MAINTENANCE
FLEET OWNER
FOOD ENGINEERING
NATIONAL PETROLEUM NEWS
NUCLEONICS
PETROLEUM PROCESSING
PETROLEUM WEEK
POWER
PRODUCT ENGINEERING
TEXTILE WORLD

THE MEN YOU NEED ARE THE MEN WHO READ THE

McGRAW-HILL PUBLICATIONS
330 West 42nd St.,
New York 36, N. Y.

DEVELOPMENT WITH - - -

Linde

Our expanding program offers challenging opportunities to graduate CHEMISTS and ENGINEERS who have imagination and creative ability. Projects include MARKET RESEARCH and DEVELOPMENT on such materials as:

- **LIQUID NITROGEN**
  - indefinite preservation and processing of biological materials
  - application of liquid nitrogen temperature in the shipment of frozen foods without intransit refrigeration
  - application of extreme pressures and low temperatures
- **MOLECULAR SIEVE ADSORBENTS**
  - catalysis and hydrocarbon separation
  - process development and plant design

The magnitude and diversity of LINDE products and processes are appealing to technical men who are seeking employment with a dynamic company of proven stability.

Bachelors, Masters and Ph.D's are invited to investigate.

If interested submit resume covering education (approximate academic standing), experience and background to:

LINDE AIR PRODUCTS COMPANY
a division of
UNION CARBIDE AND CARBON CORPORATION
P. O. Box 44, Tonawanda, New York
Attention: Mr. P. I. Emch
Refer to ad: CEG-D

ADVERTISING MAN WANTED FOR TECHNICAL PRODUCTS

- Previous advertising experience not necessary but helpful. Must have at least two or three years of college with courses in engineering and technical subjects and like to write. If you have the qualifications we have an opportunity open for you. Man selected will be trained in all phases of industrial advertising. In your letter of application state age, education, positions held, and give statement of why you want a career in advertising. Location: well-known Connecticut company.

P-1209, Chemical Engineering
330 W. 42 St, New York 36, N. Y.

WANTED

CHEMICAL ENGINEERS

For process development and production work. Two to five years' experience preferred. Modern expanding chemical manufacturing plant in New Martinsville, West Virginia. Long-range multi-million-dollar expansion program now in progress. Modern research and development facilities just completed. Excellent opportunities.

Write

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
New Martinsville, W. Va.
Attention: Industrial Relations Dept.

***New Advertisements* received by July 3rd will appear in the August issue, subject to space limitations.**
Classified Advertising Division
CHEMICAL ENGINEERING P. O. Box 12
New York 36, N. Y.

(Additional Employment Advertising on following page)

EMPLOYMENT OPPORTUNITIES

(Continued from pages 387-389)

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED —RATES— DISPLAYED

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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS or Inquiries to Classified Advertising Div. of Chemical Engineering, P. O. Box 12, N. Y. 36, N. Y. for August issue closing July 3rd

Design Engineers
Design Draftsmen

If you want

- HIGHEST EARNINGS
- OVERTIME WORK
- PERMANENT EMPLOYMENT
- OPPORTUNITY TO ADVANCE
- IDEAL WORKING CONDITIONS
- AIR-CONDITIONED OFFICES
- MANY OTHER BENEFITS

Please be sure to contact or see

Arthur G. McKee & Co.

with Engineering Offices in

CLEVELAND, OHIO and UNION, N. J.

McKee is a 50-year-old Engineering and Construction firm doing business on a world-wide basis.

Interesting, well-paying positions for

DESIGNERS, ENGINEERS, DESIGN DRAFTSMEN and DRAFTSMEN qualified in

PIPING	PRESSURE VESSELS
CONCRETE	EQUIPMENT SPECS.
STRUCTURAL	ARCHITECTURAL
ELECTRICAL	MECHANICAL

Refinery, Chemical, Blast Furnace, Steel and Sintering Plant, Industrial or Office Building design or drafting experience desirable but not necessary.

The expanding McKee organization, with three engineering divisions, Refinery, Metals and Industrial, offers many interesting opportunities in these highly-paid fields.

Investigate the opportunities McKee can offer you. If you want complete information write for our free booklet "Your Future in Engineering".

Please see or contact:
Edward A. Kelner

Arthur G. McKee & Company
2300 Chester Avenue • Cleveland 1, Ohio
TOwer 1-2300

Chemical Engineers

Production Engineering or Research and Development experience preferably with acids, heavy chemicals, and/or explosives. Excellent starting salary, benefit program, and advancement opportunity. Submit resume of education and experience to:

Liberty Powder Company
Wabash River Division
Newport, Indiana
Subsidiary of Olin Mathieson Chemical Corporation

— WANTED —

SURPLUS LOTS

VALVES & PIPE FITTINGS

Unused—Any Type—Any Quantity

PRUDENTIAL PLUMBING PRODUCTS

Foot of Centre Street — Newark 2, N. J. — MArket 4-2277

BUY OR SELL

Steel, aluminum, stainless steel, or polyephylene drums. Sizes 15-30-55 gallons.

JOHN EDWARDS
350 Rider Avenue — Bronx 51, N. Y.
Mott Haven 9-4870

WANTED—DOUGHMIXER

Baker-Perkins or equal Vacuum type, Stainless Steel, O. L. Sigma blades, tilting, jacketed, rated ½ H.P. per gallon. Working capacity 72-200 gallons. Immediate delivery required.

W-2061, Chemical Engineering
330 W. 42 Street, New York 36, New York

FOR SALE

Day Blenders—Stainless—80 Gal Cap.
27" Ball Mill Loaders & Unloaders (Stainless)
De Laval Oil Purifier—Model 84-11, 600 G.P.H.
Stokes Model "F" Pill Press
Stokes Model 43A Oscillating Granulator
75 Hummer Screens—40 Mesh. Stainless
Equipment is new and almost new, write for specifications and low prices.

GLOBE TRADING COMPANY
1815 Franklin St. — Detroit 7, Mich.
Wo. 18277

WE NEED

All Kinds of Oil Refinery and Chemical Equipment, also Tanks

Write — Wire — Phone

Weinstein Co., Div. of Surplus & Salvage Co., Inc.
618 West 8th Street — Jamestown, New York

ACTION SALE!

BUY BELOW MARKET
CHEMICALS — DRUGS, ETC.
WRITE FOR FREE LIST OR SUBMIT SPECIFIC INQUIRIES.

CHEMICAL SERVICE CORPORATION
80-04 Beaver Street — New York 5, N. Y.

COMPRESSOR DIRECTORY

World's Best Rebuilts

95 CFM	1500 psi (3) stage	Chicago TCB-3
100 CFM	100–150 psi 6 x 7	Ingersoll ES NL-oil-less
107 CFM	800 psi 7-¼ x 8	Ingersoll ER-2
138 CFM	100 psi 7 x 7	Ingersoll ES NL-oil-less
234 CFM	100 psi 9 x 9	Ingersoll ES-Worth. HB
268 CFM	500 psi 10-4½ x 10	Ingersoll XOB
283 CFM	35 psi 10 x 7	Ingersoll ES
290 CFM	75 psi 10 x 9	Ingersoll ES
380 CFM	500 psi 11-5 x 13	Worth. HB-2
410 CFM	20 psi 12 x 7	Ingersoll ES-Gardner RX
628 CFM	100 psi 14 x 13	Chicago TB
1184 CFM	Vacuum 22 x 9	Penn 7-AT
1665 CFM	.42 psi	Ingersoll XRE-1 175 HP 3-60-550

50-600 CFM Portable—Gas—Diesel
For Sale or Rent

American
AIR COMPRESSOR CORP.
NORTH BERGEN, N. J.
Telephone UNion 5-4848

HAMMER MILLS—Mikro # 1 and 24", Jeffrey 15 x 8, 24 x 20, Gruendler #2 w 3 feed screws, Raymond screen mill
SCREENS—Tyler Hummer 3 x 5 single/double—4 x 5 single, 3 x 10 double
MIXERS—13 gal Stokes, 5 cu. ft. Lancaster EBG3-EAG3 (muller type), 3000 & 6000# ribbon blenders
PEBBLE MILLS—12 x 24, 24 x 24, 24 x 36, 4 x 5, 5 x 6 porcelain, 6 x 8 & 6 x 9 buhrstone, 24 x 16 rubber-all w/motors
BALL MILLS—12" x 24" Marcy, Hardinge 6 x 22 w/new litanite lining, 7 x 48 buhrstone lining, tube mill 5' x 21' Prosser
VACUUM PUMPS—Nash Hytor 623, 1263, H6, Ing. Rand Type 30, 18CFM & 60 CFM, Leiman 100 CFM
BLOWERS—Spencer 150 CFM, 16 OZ, 1300 CFM 16 OZ & STURTEVANT Size 115 Design 7, 36000 CFM (unused)
ROTARY DRYERS—KILNS—12" x 22', 36" x 25', 30" x 21', 44" x 25', 6' x 40'
ROLL CRUSHERS—16 x 10, Sturtevant, 30 x 16 Chambers, 24 x 24, Link Belt (single), 24 x 36 McLanahan (single)
JAW CRUSHERS—20 x 4 Farrel, 14 x 28 Acme, 36 x 20 Diamond
AUTOCLAVE—1 gal s/s 1000 psi/150 psi jacket-expl. prf. gearmotor
REDUCERS—3 HP Reeves varidrive—12 to 36 RPM, 3 HP Delaval 45/1 25 HP Jones 25/1, 40 HP Phila. 250/1
LIGHTNIN' MIXERS—¼ HP geared, ½ HP direct, 1 HP 1150 direct, all w/new shaft and propellers

LAWLER COMPANY
Durham Avenue — Metuchen, N. J.
Liberty 9-0245

SEE OUR STOCK

FOR SALE

Waste Disposal Plant including Oliver Precoat Filter 5'3" dia. x 8' face with Nash Hytor Vacuum Pump and motor; 18' dia. leadlined steel reacting tank, piping, pumps, agitators, etc. Built 1951 —UNUSED

CENTRIFUGALS

1—AT&M Susp. 48" dia. Perf. Basket, St. St., Fume tight
2—Fletcher Susp. 40" dia. Imperf. Basket, 1 plain steel, 1 rubber covered
1—Tolhurst Susp. 26" dia. Imperf. Basket, Steel
1—Bird 36" x 50" Solid Bowl, Steel
1—Bird 24" x 24" slotted bowl, Steel
4—DeLaval Nos. 74-11; 94-01; 600

DRYERS

4—Devine #27 Vacuum Shelf, 475 sq. ft.
1—Devine #23 Vacuum Shelf, 365 sq. ft.
2—Devine Vacuum Shelf Dryers, size 17, 80 sq. ft. UNUSED.
1—St. St. Spray Dryer, 19' dia. x 20' high, with Western Precip. nozzles, fans, oil burners, etc.
1—Bowen 5' dia. Stainless Steel Spray Dryer
1—Stokes 3' dia. x 15' long Jacketed Rotary Vacuum Dryer
5—Double Drum Dryers: 42" x 120"; 32" x 52"; 24" x 60"; 24" x 36"; 22" x 38"
5—Rotary Hot Air Dryers or Kilns: 6' x 50'; 4'6" x 40'; 4'6" x 32'; 3'6" x 25'; 3' x 24'
2—Rotary Coolers: 104" x 30' and 104" x 70'
1—B & S Rotary Hot Air Dryer, 3' x 15', Everdur
3—Rotary Furnace Tubes 24" D x 8'6" L x ¾" Chrome nickel Alloy
1—Hardinge XC-2 Ruggles Coles Rotary Steam Tube Dryer, 4' D x 30' L
2—Davenport size 2A Dewatering Presses
2—Swensen Walker Crystallizers, steel, jacketed, each 30' long

EVAPORATORS—STILLS

1—Conkey 1900 sq. ft. Triple Effect, Vertical long Herculoy tubes
1—Buflovak size 6.5 model 629D Double Effect, all stainless steel, 588 sq. ft.
1—Stainless Steel, 145 sq. ft. coil, 500 gal.
1—Stokes 150 gal. St. St. Jacketed Vacuum Still
10—Columns—Aluminum, Copper & Stainless Steel
2—Bartlett Snow St. St. Jacketed Evaporating Kettles 6' dia. x 3' deep with heavy duty agitator and 25 HP 4-speed drive.

AUTOCLAVES

2—Blaw Knox ½ gal. St. St. agit. 2000# Pr.
3—St. St. T347, 13 gal. 1400# test, 50# jkt.

FILTERS

Niagara Model 510-28 type 316 Stainless Steel Filter, 510 sq. ft. with extra set leaves.

1—Feinc 6'6" D x 6' Face String Discharge
2—Eimco 10' x 12' Rubber Covered Filter
3—Sweetland Filters: #12 (72 lvs.); # (20 lvs); #2 (18 lvs.)
5—Cast Iron Filter Presses, 30" x 30" open delivery, 28, 35, and 50 chambers
4—Filter Presses, closed delivery, 12" to 36"

MILLS

1—Hardinge 6' D x 22" L Conical Ball Mill, Steel Liner
4—Pebble Mills 6' D x 8' L, 45" x 42"
1—Al. Ch. 6' D x 16' L Steel Lined Contin. Ball Mill
2—4'6" D x 12' L contin. Pebble Mills
1—Charlotte #50 Colloid Mill, 75 HP
1—Penna Ring Type Granulator, Trojan K3-24, 40 HP
3—Fitz. Comminutors St. St., F-8, K & D
6—Hammer Mills: Jeffrey 42 x 36; Gruendler 36 x 24; Jay Bee 75 HP; Williams 14" x 14", Williams size A, St. St. and Aluminum
1—Sturtevant 8 x 10 Jaw Crusher
3—Attrition Mills, 30", 24" & 16"
1—Pug Mill, St. St., two 7" dia. overlapping chambers 3'9" L. Jktd.
3—Mikro Pulverizers #2-DH, 2-TH, 3-TH

MIXERS—BLENDERS

2—Day 75 gal. work. cap. Stainless Steel Sigma Blade double arm jacketed mixers
2—Readco Heavy Duty Double Arm Sigma Blade Jacketed Mixers 50 gal. work. cap. 30 HP Expl. Pr. Motor. Built 1951-53
3—Sprout Waldron size 12 Ribbon Mixers, 336 cu. ft. work. cap.
3—W & P Sigma Blade Double Arm Jacketed Mixers, 50 gal. & 100 gal. work. cap.
9—Side Entering Stainless Steel Mixers, 7½ HP, 10 HP, 15 HP & 25 HP
3—Falk Vertical Agitator Drives #10-GDX, 10:1, 300 HP—UNUSED
8—Turbo Vertical Drives, #5B, 5:1, 40 HP
3—Lancaster type SKG Counter Current Mixers, 29½" dia. pan
1—Sprout Waldron type 3036 Swing Head BB Blender, 50 HP
1—Patterson 5' dia. Conical Blender

MARCO FLOW-MASTER UNITS
Stainless Steel
New in 1952—Expl. Pr. Motors

1—KACR Reactor, ser. #3127
1—Kom-Bi-Nator, 200 GPH #3114
1—AC-500 Homogenizer, #3125
2—Roto-Feed Mixers, #3129, 3130
1—DP-Dry Proportioner, #3131

TANKS

12—Aluminum, 3000 gal., 5 compart.
10—Aluminum, 500 gal., 80# WP.
1—Monel, 450 gal., ¼"
1—St. Clad, T304, ⅜"; 6500 gal. Vert.
10—St. St. Pressure Tanks—to 4000 gal.
20—St. St. Storage Tanks—to 1000 gal.

STAINLESS STEEL EQUIPMENT

USED EQUIPMENT IN STOCK—Tanks, Kettles, Receivers, Exchangers and Condensers, Stills, Agitators, etc.

NEW TANKS IN STOCK—From 30 gal. to 10,500 gal. sizes. Also large stock of prefabricated tank sections and heads to assure quick delivery of tanks.

CONVERTING EXISTING EQUIPMENT—(Your own equipment or our stock)—Can be done in our own shops utilizing surplus new or used materials on hand. HELIARC WELDING—Water Quenched Stabilized welds.

Equipment Bought & Sold

Plants Liquidated

BOTTLING CANNING MACHINERY PERRY SUPPLIES PROCESSING

PERRY EQUIPMENT CORP.

Phone ST ovenson 4-7210

Cable—PERI

1413-21 N. 6TH ST. **PHILADELPHIA 22, PA.**

$1,000,000 LIQUIDATION
MODERN ANTIBIOTIC PLANT
LAWRENCEBURG, IND.

(25 miles from Cincinnati, Ohio)

THIS PLANT MANUFACTURED PENICILLIN, STREPTOMYCIN AND B-12. MOST OF THIS EQUIPMENT HAS HAD LITTLE USE. OPERATIONS INCLUDE—FILTRATION, FERMENTATION, EXTRACTION, CRYSTALLIZATION, FREEZE DRYING, FINISHING AND PACKAGING.

Send for Circular

REACTORS, KETTLES, TANKS

Stainless Steel

8—1000, 550, 250, 200, 100 and 50 gal. jacketed, agitated Reactors.
2—500 and 150 gal. Closed, jacketed Kettles.
4—Stacy 9'x35'6" Vertical, Steel Fermenters 17,000 gal., 20% Stainless clad head with Stainless Steel coils and 150 HP Turbo Agitators.
4—Stacy 3000 and 2000 gal. Vertical Closed Tanks with Stainless Steel coils and side agitators.
3—Graver 500 gal. Vertical, closed Tanks, side jackets.
6—500 and 550 gal. Closed, Vertical Tanks.
20—40 gal. Portable Tanks on trucks.

Glass Lined

9—Pfaudler 750, 350, 250, 200, 100 and 50 gal. jacketed, agitated, Reactors.
2—Pfaudler 2500 gal. Vertical, closed Tanks.
6—Pfaudler 1400, 1000, 400, 350 and 200 gal. Vertical, Closed Tanks.

Steel

30—Graver 40"x37' high, Vertical Tanks, side jackets, 2400 gal.
21—Graver 40"x7' Vertical Tanks, side jackets, 500 gal.
2—Stacy 7'6"x10'9" high, Closed, Vertical Tanks 2700 gal.
5—Vertical, Closed Tanks 10,000 to 20,000 gal. 12'x12', 15'x16', 12'x8' cone bottom.

CENTRIFUGES & FILTERS

11—Podbielniak Model 7100 Stainless Steel Centrifugal Extractors, 10 HP XP motors and accessories.
1—Bird 40" Suspended Centrifugal, bottom discharge, steel imperforate basket, 30/7½ HP motor.
1—Tolhurst 26" center-slung Centrifugal, Stainless Steel perforated basket, vapor-tite 2 HP motor.
2—Bird-Young 4'x2' Rotary Vacuum Filters.
2—Shriver 24"x24" rubber covered Filter Presses, 4 eye, P&F, 18 chambers.
1—Republic 15"x15" Stainless Steel Filter Press P&F, 20 chambers.

SELECTED ITEMS

4—17,000 gal. Fermenters with Stainless Steel coils and 150 HP Turbo Agitators.
14—I.R. Air Compressors 215 to 1500 cfm.
10—York and Cyclops Ammonia Compressors.
4—National Research Vacuum Diffusion Units Model V-10-D.
11—Podbielniak S.S. Centrifugal Extractors.
17—Stainless and Glass Lined Reactors 50 to 1000 gal.
3—Stainless Steel Stills with Condensers 150 to 500 gal.
4—Stainless 3000 and 2000 gal. Tanks with S.S. coils and agitators.
17—Stainless and Glass Lined Tanks 200 to 2500 gal.
1—Kathabar size 500 BLT Dehumidifier.
2—Bird-Young 4'x2' Rotary Vacuum Filters.
3—Precision Hot Air Stainless Sterilizers, Type B.
3—R. A. Jones Aut. Cartoners for Vials.
3—Perfectum Vial Washers.
77—Centrifugal Pumps, Stainless and Bronze.
17—Kinney and Nash Vacuum Pumps.
150 Recording and Control Instruments.

Inspection Invited

DRYERS & OVENS

10—Stokes, Devine and National Research 8 and 10 shelf, Vacuum Shelf Dryers.
6—American Sterilizer and recision Co. Stainless Steel Sterilizers.

COMPRESSORS & PUMPS

14—Ingersoll Rand Air Compressors 1500, 1300, 1000, 750, 628, 240 and 215 cfm with motors, receivers air filters and after-coolers.
10—York Ammonia Compressors, Model D-8, 10"x7½", 8"x6", 6"x6", 5"x5" and 4"x4" with motors and accessories.
15—Kinney Vacuum Pumps 100 and 200 cfm.
2—Nash Vacuum Pumps 300 cfm.
77—Ingersoll Rand, Peerless, Dayton-Dowd and Worthington Stainless and Bronze Centrifugal Pumps 1/3 to 20 HP.

MISCELLANEOUS

5—Kathabar, Trane, Air Conditioning and Dehumidifying Units.
35—Lightnin and Turbo Agitators, from ¼ HP to 7½ HP.
4—Lightnin and Turbo Agitators, 125 HP.
1—Patterson-Kelly 5 cu. ft. S.S. "V" Mixer.
2—Bantam Mikro Pulverizers, Stainless Steel.
3—Perfectum Model W78, W57 and W20 Vial Washers.
3—R. A. Jones Automatic Cartoning Machines for Vials.
6—Glass Lined Absorption Columns 2'x12', 14"x10'.
2—Stainless Steel Water Stills 50 and 100 gph.
5—Stainless Steel Condensers 50 to 400 sq. ft.
150 Recording and Control Instruments, Foxboro, Brown, Beckman Ph Meters, Taylor and Manning.
50—Fischer Porter Rotameters.
50—Stainless Steel Trucks, 1000 Stainless & Aluminum Trays, Packaging Plant consisting of Conveyors, Labelers, Unscramblers, Printers etc. Large quantity of Steel, Brass & Stainless Pipe, Valves, Fittings & Structural Steel.

For Inspection or Further Information Contact: **Mr. T. Geldan or Mr. L. Kahn, Box 190, Lawrenceburg, Ind., Telephone 714**

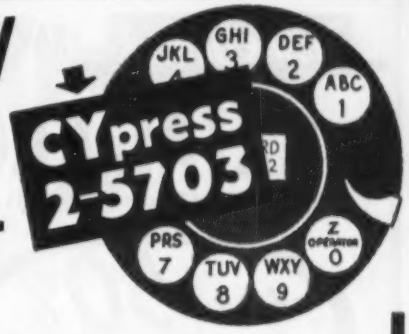
Or

BRILL EQUIPMENT COMPANY
2401 THIRD AVENUE, NEW YORK 51, N. Y.
Telephone: CYpress 2-5703 • Cable: Bristen, N. Y.

A SINGLE ITEM OR A COMPLETE PLANT

Write, wire or phone us for complete information. Send us your surplus equipment lists today.

Make this call get "on the ball" with BRILL EQUIPMENT



IN STOCK AND AT OTHER LOCATIONS

DRYERS

2—Vulcan 6'x40', 4½'x50' Rotary.
1—Link Belt 5'2"x20' Roto-Louvre.
1—Link Belt 7'5"x25' Roto-Louvre 304 S.S.
4—Devine double door Vacuum Shelf 17 and 20—59"x78" shelves.
1—Devine 4'x25' Rotary Vacuum.
1—Devine 5'x10' Rotating Vacuum.
3—Buflovak double drum 42"x120", 42"x90", 32"x90".
2—Hersey 3'x15', 1½'x12' Rotary, 304 S.S.

FINAL LIQUIDATION

Baton Rouge, Louisiana

1—I.R. Jet Refrigeration Unit complete 208 tons 65° to 60°F.
1—Buflovak 6'x5'6" Monel Drum Flaker, NEW.
1—Pfaudler 250 gal. Hastelloy "C" Reactor.
3—4'x13' closed 316 S.S. Reactors, 109—3'6", 316 S.S. tubes, 150 psi.
1—2500 gal. 304 S.S. jacketed Reactor.
1—Pfaudler 5'x18" Horiz. glass lined 2500 gal.
1—7500 gal. 304 S.S. clad 12'x6'x 5'6" cone.
3—Link Belt 316 S.S. 18"x12", 18"x 10', 18"x7' Twin Conveyors.
200 ft. 18" Troughing Belt Conveyor with housing.

FILTERS

2—Oliver Rotary, Monel 8'x10', 3'x2'.
1—Feinc 5'x7', 304 S.S. Rotary Vac.
1—Feinc 5'x3' Monel, Rotary Vac.
3—Eimco 18"x24", 18"x12", 316 S.S. Rotary Vac.
2—Sweetland #12, 72 and 36 leaves.
2—Sweetland #3, 75 sq. ft., 304 S.S.
1—Niagara 53 sq. ft., 304 S.S.
1—Shriver 42" P&F, 40 chambers, wood.
3—Shriver 30" P&F, 36 chambers, iron.

PULVERIZERS—CRUSHERS

2—B&J #1½, #2 Rotary Cutters.
4—Hardinge Mills 4½'x16", 6'x22", 7'x36".
1—NEW Patterson 6'x8' porcelain Pebble Mill 50 HP.
1—National 6"x12" Plastic two-roll Mill.
2—Mikro Pulverizers #2TH and Bantam.
8—Jeffrey 24"x20", 18"x12", 15"x8" Hammermills, NEW.

CENTRIFUGALS

2—Bird 40" Suspended, 347 S.S., XP motor.
1—AT&M 40" Suspended, steel.
1—Bird 40" Suspended, rubber.
3—Tolhurst 40", 32", 26" Suspended, steel.
1—AT&M 36" center-slung, rubber.
1—Fletcher 30" center-slung, 304 S.S.
1—Fletcher 20" Suspended, 304 S.S.
2—Bird 32"x50", 36"x50" steel, solid bowl Continuous.
2—Bird 24"x38", 18"x28" 304 S.S. Solid Bowl, Continuous.
2—Sharples #C-27, #C-20, 304 S.S. Super-D-Hydrators.
1—Sharples #PN-14 Super-D-Canter, 304 S.S.

SCREENS

4—Rotex double and single deck 40"x 120", 40"x84".
3—Robinson single deck 40"x84", 304 S.S.
3—S. W. single deck 40"x84", 304 S.S.

MIXERS

1—Baker Perkins #16 UUMM, 150 gal. Dispersion Blades, 100 HP, XP motor.
1—Baker Perkins #JNM-2, 50 gal., 304 S.S., Sigma Blades.
8—Day "Cincinnatus" double arm Sigma Blade 550, 200 and 100 gal.
2—Robinson 90 cu. ft. 316 S.S. jacketed, Powder.
1—4' dia., 304 S.S. Conical Blender 7½ HP motor.
9—Steel jacketed Powder, 50, 225, 265, 350 cu. ft.
1—Robinson 4000# steel Powder.
1—Simpson Intensive Mixer #0.
8—NEW Portable Agitators ¼ to 5 HP.
4—Day, Ross 8 and 50 gal., Pony.

TOWERS—REACTORS—CONDENSERS & TANKS

5—Steel Storage Tanks 10'x40', 8½'x 25', 8'x16', 6'x20'.
8—Towers 7'x25'6", 347 S.S., 6'x63', 6'x34', 5'x96', 30"x70', 24"x42', 12"x 30', 8"x20'.
1—10,000 Aluminum Storage Tank 10'x16'x¼" shell, 25# W.P.
4—Foster Wheeler Karbate Heat Exchangers 188 sq. ft.
1—Struthers-Wells 536 sq. ft., 304 S.S. Heat Exchanger.
5—Stainless Steel Heat Exchangers 947, 160, 70, 58 and 55 sq. ft.

LIQUIDATION

Near Longview, Texas

Complete Poly Unit, Built 1950 rated 144 bbl/day

1—Wyatt 30"x70' Stabilizer 160#, 30 tray.
30—Brown fintube Exchangers 20 to 140 sq. ft.
1—5'x96' Tower, 40 tray, 135# W.P.
1—7'x30' Propane Tank 250# W.P.
1—6'x34' Vacuum Tower 150#.
1—2'x50' Tower, 24 trays.
2—Convection Furnaces 20 MIL BTU/hr.
12—Welded Storage Tanks 5000, 2000, 1000, 500 bbl.
6—Steel Bldgs., 20x150, 12x20, 20x40.

MISCELLANEOUS

2—Lawrence 5" Hastelloy "C" Centrifugal Pumps.
8—Nash Vacuum Pumps #H-8, #H-7, #H-6, #4, #2, #L-5, #L-3, #MD571.
3—Stokes 412 and 212 Vacuum Pumps.
20—Durimet, Olivite 316 S.S. Duriron Centrifugal Pumps 1" to 3".
10—Centrifugal Pumps 60 to 2000 gpm, motor driven.
4—Stokes DD82, DS3, "R", "T" and "F" Tablet Machines.

IF YOU DON'T SEE IT LISTED—ASK FOR IT—WE HAVE IT

TEXAS OFFICE—4101 San Jacinto St., Houston 4, Texas—Tel.: Jackson 6-1351

BRILL EQUIPMENT COMPANY
2401 THIRD AVENUE, NEW YORK 51, N. Y.
Telephone: CYpress 2-5703 • Cable: Bristen, N. Y.

A SINGLE ITEM OR A COMPLETE PLANT

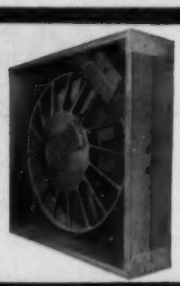
Write, wire or phone us for complete information. Send us your surplus equipment lists today.

New & Unused **HEAVY DUTY INDUSTRIAL MODEL**

AXIAL FLOW FANS

Manufactured by the DELCO DIVISION of GENERAL MOTORS

offered at 50% of General Motors Delco Price!



HEAVY DUTY INDUSTRIAL MODEL
ENCLOSED WEATHER-PROOF MOTOR
CAST ALUMINUM ALLOY
CONSTRUCTION THROUGHOUT

For the Control of

- FUMES • STEAM • ODORS • DUST • VENTILATION
- COOLING OF WORK IN PROCESS • CROP DRYING
- INDUSTRIAL VENTING • PERSONNEL COOLING
- FORCED COOLING OF ELECTRICAL EQUIPMENT

Standard model, mounted in framing unit, ready to install in sash, building opening or duct system. Frame designed for ready attachment of louvre, duct or hood.

16,500 C.F.M. STATIC PRESSURE
(18,500 C.F.M. FREE DELIVERY)

• STEEL & NON FERROUS METAL WORKING PLANTS • CHEMICAL PLANTS
• FOUNDRIES • POWER PLANTS • CROP DRYING • MACHINE SHOPS • MILLS—MINES
• FABRICATING & WELDING SHOPS • FOOD PROCESSORS • ELECTROPLATERS

Model 81—1791Y Framed Unit—4 H.P.—220 Volt—60 Cycle Single Phase—1200 RPM
81—4454Y Framed Unit—4 H.P.—220/440 Volt—60 Cycle 3 Phase—1200 RPM
81—4450Y Unframed Unit—4 H.P.—220 Volt—60 Cycle Single Phase—1200 RPM

Framed Fan—Mounting Frame Outside Dimensions:
45⅛" x 45⅛" x 11¹⁵⁄₁₆"—Wt. 484 lbs.
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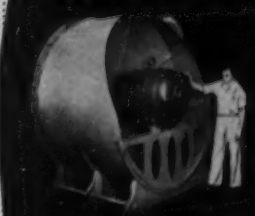

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1—Baker Perkins ter Meer, Type 316 Stainless Steel Centrifugal Filter, Model HS-24", complete.
1—H. K. Porter Stainless Steel Jacketed 500 gallon Reactor.
1—Hardinge Rotary Dryer, 7'6" x 55'.

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1—Pfaudler Glass-lined Jacketed Reactor, 200 gals.
10—Aluminum Horizontal Storage Tanks 9' x 36', 17,000 gallons each.
1—Pfaudler Glass-lined Jacketed Reactor Series R, 750 gal.
1—Pfaudler Glass-lined Jacketed Kettle, 10 gallons.
1—Pfaudler Glass-lined 150 gal. Jacketed Evaporating Pan with Tilting Mechanism.
1—Plate Fabricators Steel Jacketed Kettle, 8000 gal.
6—Patterson Steel Jacketed Kettles, 2500 gallons each.

CENTRIFUGALS

1—Tolhurst Stainless Steel 26" Center Slung Centrifuges.
1—AT&M Stainless Steel Centrifuge, 48" Imperforated Basket, complete with motor and plow.
1—Fletcher Stainless Steel Suspended Type Centrifuge 40" Perforated Basket, complete with motor.
3—Sharples Stainless Steel Super-Pressurite Centrifuge, Model 16Y.
1—DeLaval Type 316 Multimatic Centrifuge.
1—Tolhurst Center Slung 12" Laboratory Centrifuge.
3—Stainless Steel Jacketed Stills, 60 gallons each.
1—Graver Stainless Steel Vertical Storage Tank, 3500 gallons.

DRYERS AND KILNS

8—Stokes Vacuum Shelf Dryers, 8 shelves each.
1—Buflovak Double Drum Dryer, 42" x 120", ASME, complete.
2—4'6" x 40' Rotary Dryers
1—Devine Stainless Steel Laboratory Vacuum Shell Dryers, 3 shelves (New).
5—Buflovak & Devine Vacuum Shelf Dryers, 5 to 20 shelves.
1—Bartlett & Snow Rotary Dryer, 4'6" x 36'6".
1—Devine Steel Jacketed Rotary Vacuum Dryer, 5' x 20'
1—Link Belt Roto Louvre Dryer, Model 502-20.

MISCELLANEOUS

2—Baker Perkins Laboratory Mixers, Size 4AN2, 0.7 gal. cap.
1—Eppenbach Stainless Steel Colloid Mill QV6-1.
12—Struthers Wells Stainless Steel Heat Exchangers, 650 sq. ft. ea.
1—Struthers Wells Carpenter #20 Stainless Steel Heat Exchanger, 580 sq. ft.
5—Aluminum Heat Exchangers from 5 to 150 sq. ft.
3—Swenson Walker Stainless Steel Jacketed Crystallizers, 20' long.
1—Worthington Air Compressor, Model HB with 50 HP motor, complete.
1—Day Stainless Steel Sigma Blade, Jacketed Mixer, 200 gallons.

FILTERS

2—Sperry Cast Iron Plate and Frame 4-eye Closed Delivery Filter Press 24" x 24" with 40 ch. ea., Hydraulic Closing Device.
1—Sperry C. I. 36" x 36" 4-eye Closed Delivery Plate and Frame Filter Press with 35 ch.
1—Oliver Rotary Vacuum Filter, Rubber-lined, 3' x 6', complete.

2—Bird Continuous Centrifugal Filters, 24" x 38".
1—Eimco Type 316 Stainless Steel Rotary Vacuum Filter, 18" x 12".
1—Mikro #4TH Pulverizer with 60 HP motor.
1—Baker Perkins Double Arm Dispersion Blade Jacketed Vacuum Mixer, 150 gal working capacity with 100 HP motor.

1—Sperry C. I. 36" x 36", 4-eye Closed Delivery, Washing Type Filter Press, with 32 chambers, 1" frames.
10—Sweetland #12 Filters with 72 Stainless Steel leaves.
1—Republic 15" x 15" Flexmaster Stainless Steel Filter, 15 chambers.

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JULY 1956

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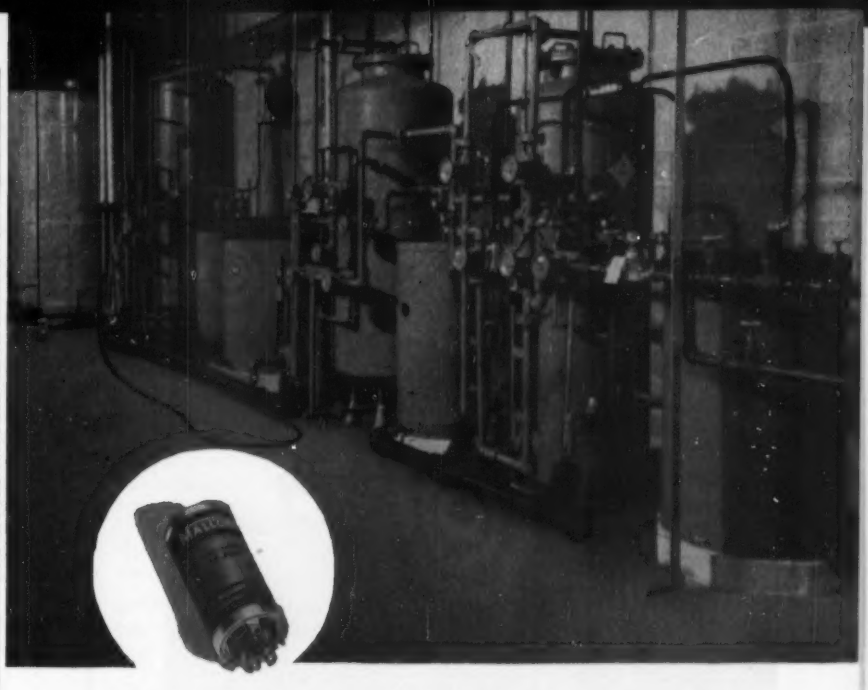

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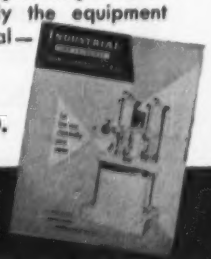

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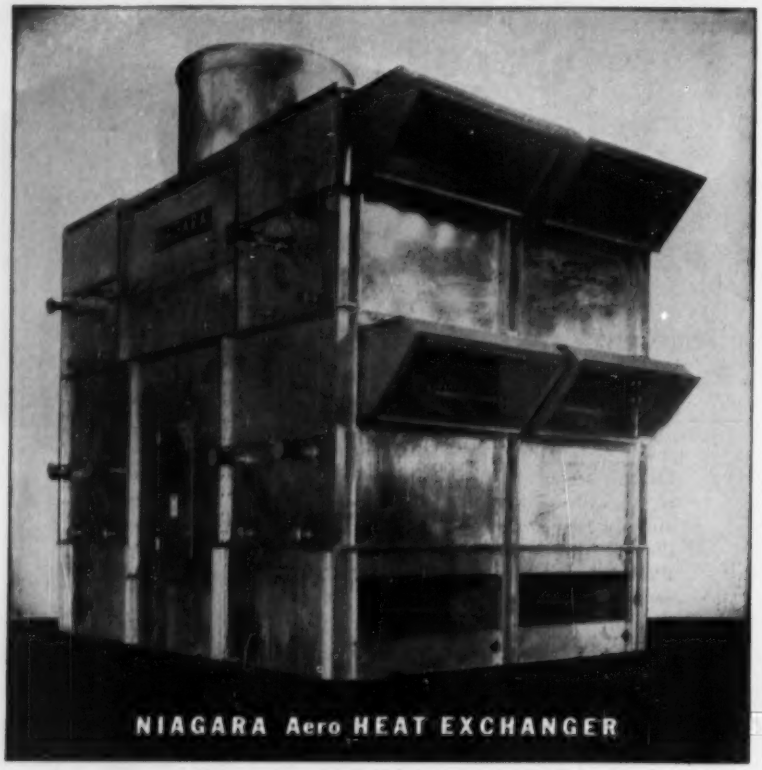

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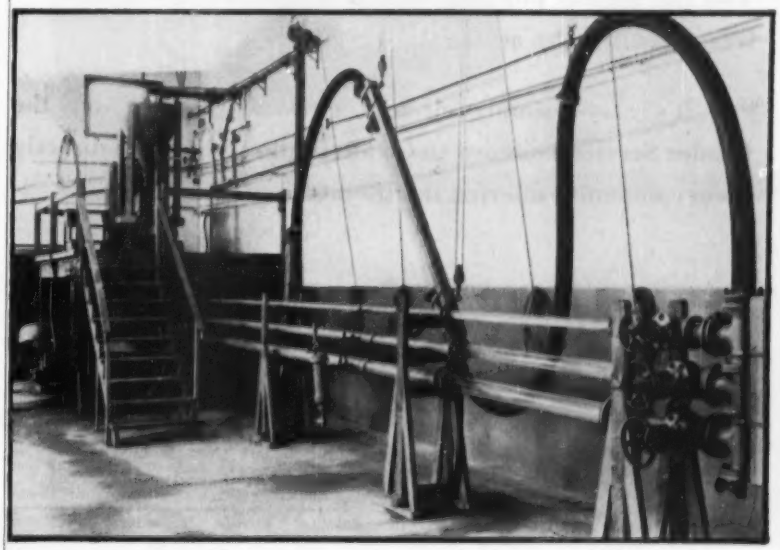

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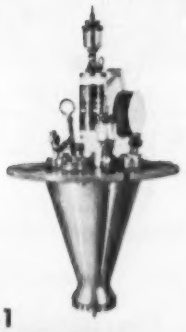

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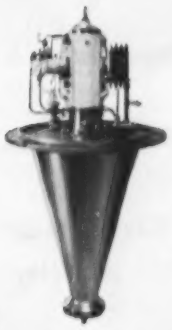

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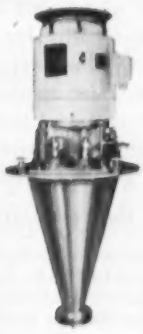

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These Fig. 3705 Goulds stainless steel pumps move hot sulphate (50° C.) and potassium chloride (40° C.) solutions with as high as 30% solids, at the Carlsbad, N. M. plant of the International Minerals and Chemical Corporation. The Fig. 3715 pump discussed below is an improved design of this pump.

No heartburn in these pumps as they move *hot, corrosive* and *abrasive* liquids

The sulphate and potassium chloride solutions handled at this plant would soon eat the heart out of an ordinary pump.

That's why International Minerals and Chemical Corporation uses Goulds *chemical* pumps.

They are available in Gould-A-Loy 20 stainless steels, all iron, all bronze, iron with stainless steel or bronze trim, and bronze with stainless steel trim. You can fit the pump to the job, obtain many long years of trouble free service.

Here are just a few of the other extra features you get:

1. You can move liquids at temperatures up to 350° F., because the pump has quenchable cowl-type glands and cooling chamber in the support head.

2. Stuffing box on suction side of impeller gets suction pressure only, holds leakage at a minimum.

3. You can change easily from conventional stuffing box to single or double mechanical seal.

4. You can inspect and clean the pump without disturbing piping connections.

These Goulds Fig. 3715 chemical pumps are available in nine sizes with capacities up to 720 GPM and heads, depending on capacity, up to 200 ft.

See all the special features of the Fig. 3715 pump in your own office. We've made an aluminum model which you can take apart on your desk. Just ask your Goulds representative to show it to you. Or, write to our main office and we'll make the arrangements.

MEMBER — Goulds PUMPS INC. — Seneca Falls, New York

SALES OFFICES: Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

LITERATURE . . .

Polyvinyl Materials.....Products made from Geon rigid vinyl include corrosion-proof pipe, fumes ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. Request new bulletin on Geon 8700-A.
9 *B. F. Goodrich Chem. Co.

Potassium Borohydride.....Detailed reference gives composition, properties, solubility, applications, typical reductions, handling, safety and storage information. Request copy of Technical Bulletin No. 301-B.
412A Metal Hydrides.

Potassium Persulfate.....Company announces the availability of literature describing the product line. Includes information on chemical & physical properties, uses & handling. Request Bulletin No. 11.
412B Becco Chem. Div.

Propylene Diamine.....New technical bulletin presents information on the uses of propylene diamine and its physical and physiological properties, specifications & shipping data. See Bulletin F-40037.
412C Carbide & Carbon Chem.

Resin-Coated Sand.....New 16 p. booklet on resin-coated sand for shell molding is available. Advantages are: elimination of dusting, excellent blowability, resin economy, improved flowability of mix.
412D Monsanto Chem. Co.

Resins, Dry Blending.....Three "Tech Book Facts" bulletins cover processing, formulating & compounding with Pliovic Dry Blending Resins. Request the following bulletins; 55-298, 55-299 & 55-310.
412E Goodyear Tire & Rubber Co.

Resins, Electrical Grade.....Three "Tech Book Facts" bulletin cover compounding, formulating & processing with Electrical Grade Pliovic Resins. Request these bulletins; 55-180, 55-181 & 55-182.
412F Goodyear Tire & Rubber Co.

Resins, Penacolite.....Bulletin gives description, typical properties, physical & cure characteristics, applications and storage & handling information on Penacolite brittle resins B-1A, B-16, B-22. Bul. C-6-230.
412G Koppers Co.

Resins, Phenolic.....High boiling phenols and meta-phenols 220, alone or in combination with other suitable phenols, react with formaldehyde to produce useful, cross-linked, thermosetting resins. Bul. F-40059.
412H Carbide & Carbon Chem.

Resins, Plastisol.....Exon 654 is expressly created to impart excellent heat and light stability, physical toughness and chemical stability to your products. Request full information on entire product line.
103 *Firestone Plastics Co.

Resins, Polyethylene.....Tough, flexible Alathon polyethylene resin stands up well against abrasive slurries. Widely used in industrial pipe applications. Offers complete information on the properties and applications.
305b *E. I. du Pont de Nemours.

Resins, Tetrafluoroethylene.....Teflon tetrafluoroethylene resins used extensively in process industries. Offer chemical inertness, high heat resistance, low-temperature toughness, etc. Properties & applications.
305a *E. I. du Pont de Nemours.

*From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the product.

Resins, Thermoplastic.....Three "Tech Book Facts" bulletins discuss properties, calendering and laminating and compounding Plio-Tuf C75 for Calendering. See Bulletins 55-192A, 55-193 & 55-194.
413A Goodyear Tire & Rubber Co.

Silicates.....20 p. booklet lists the grades of silicate of soda and other silicated alkalies manufactured by company, with certain properties, major uses and general data to acquaint users with the materials.
413B Diamond Alkali Co.

Soda Ash.....West End is a pure white, free-flowing and rapidly soluble soda ash that produces a far cleaner, more uniform product. Announces the availability of product samples, prices, and technical information.
300 *West End Chem. Co.

Soda, Caustic....."Caustic Soda Buyer's Guide" contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc.
383a *Hooker Electrochem. Co.

Sodium Benzoate.....Company makes available technical data on its line of sodium benzoate—flake or powdered. Both are dust-free to prevent sneezing. For more complete information, request literature.
383i *Hooker Electrochem. Co.

Sodium Borohydride.....MH sodium borohydride, $MaBH_4$, will reduce esters, acids, acid anhydrides, and acid halides. Announces the availability of detailed Bulletin 502-F and typical reduction procedure.
413C Metal Hydrides.

Sodium Hydride.....Makes available a detailed technical reference containing information on: composition; properties; solubility; applications; typical reductions; handling; safety; storage. Technical Bulletin 507-C.
413D Metal Hydrides.

Sodium Hydride Oil Dispersion.....Detailed reference contains information on composition, properties, solubility, applications, typical reductions, handling, safety and storage. Request Technical Bulletin No. 508-A.
413E Metal Hydrides.

Sodium m-Silicate.....Valuable data on Drymet anhydrous—the most highly concentrated form of sodium m-silicate. Drymet File Folder contains complete technical information and suggested formulations.
B432 *Cowles Chem. Co.

Sodium Sulfhydrate.....Hooker, sodium sulfhydrate dissolves rapidly, even in cold water. There's virtually no sedimentation even after long standing. Available in 90-lb. & 350-lb. drums. Technical Data Sheet.
383j *Hooker Electrochem. Co.

Sodium Sulfide.....The clean, strong flakes dissolve right into process, even without stirring. No waiting . . . no decanting. For complete information on Hooker's sodium sulfide, request Technical Data Sheet.
383k *Hooker Electrochem. Co.

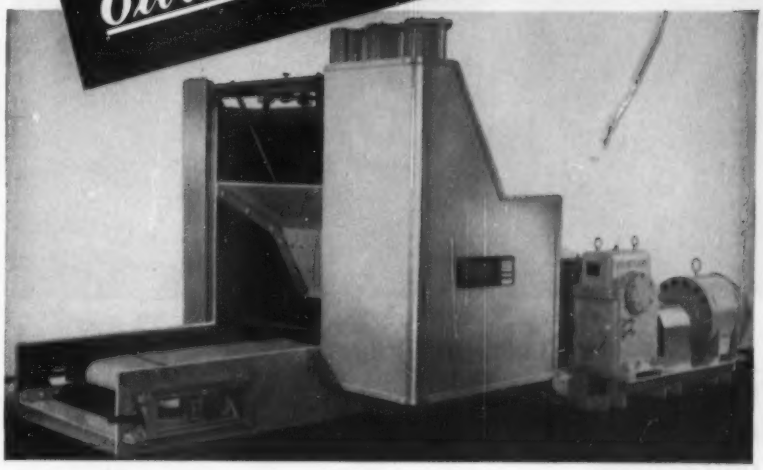
Solvents.....Assure controlled evaporation. In paint & surface coating industry . . . solvents offer precise characteristics to meet your most exacting requirements. Full data on characteristics & specifications.
245 *Esso Standard Oil Co.

Solvents.....These solvents are recommended for low odor and odorless products. Detailed specifications of these Shell Solvents are contained in the booklet, "Shell Solvents for Low Odor & Odorless Paints."
267 *Shell Oil Co.

Solvents, Odorless.....With either of Sinclair's two types of top-quality Odorless Solvents . . . you can produce a superior odorless paint. Makes available product samples, prices and complete information.
289a *Sinclair Chem.

*From advertisement, this issue

"NATIONAL" Has the Solution to Your Extruding Problems



THIS *Versatile* "NATIONAL" EXTRUDER

is designed to economically extrude a wide variety of materials, many of which could not previously be processed by this method, and to assure the extruded material of better form for subsequent handling.

The extruding operation incorporates a "National"—developed wiping motion that leaves the material less compact . . . ready for quicker, more efficient drying. Machines can be arranged for continuous tray loading, or for feeding to a continuous apron dryer . . . either in full-width load or to reciprocating spreader to wider apron. Variations in rate of extrusion are regulated by speed of rotor and pneumatic loading of ram.

ANY SIZE or CAPACITY "National" Pre-Form Extruders are available in any required size or capacity, and in any metal called for by specific conditions. They are built to the same quality specifications which distinguish all "National" Dryers . . . your guarantee of long, trouble-free service.

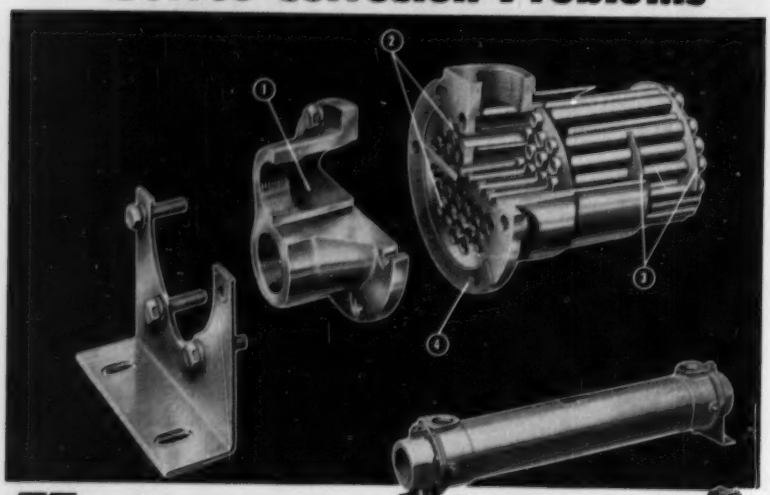
A "National" Extruder can undoubtedly be adapted to your particular requirements. Consultation invited, without obligation.

NATIONAL

The NATIONAL DRYING MACHINERY Co.
LEHIGH AVE. and HANCOCK ST., PHILADELPHIA 33, PA.

New England Agent: JONES & HUNT, INC., Gloucester, Mass.
Cable Address: "NADRYMA"—W. U. Code

Young Engineering Talent
Solves Corrosion Problems



Type "SSF" Single Pass

Type "SSF" Multipass

Young Stainless Steel heat exchangers provide more cooling surface per unit volume

The problem: Meet the Chemical Industry's need for corrosion-resistant heat exchangers.

How Young solved it

After months of testing, Young Radiator Company utilized a special type of stainless steel for fabricating heat exchangers. They are for use in the processing of highly corrosive chemical liquids and gases. The newer Young Exchangers are engineered to withstand expansion strains and have reserve capacity. They include factors for fouling, and simplified construction makes cleaning easy.

1 Smooth flow bonnet distributes fluid with minimum turbulence to tubes.

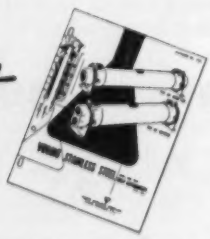
2 Tubes are rolled into headers.

3 Baffles made to close tolerance.

4 Gasket eliminates by-passing, fluid leakage.

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.



Write Dept. 316-G for Free Catalog.

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Offices: Racine, Wisconsin, Plants at Racine, Wisconsin, Matteson, Illinois

Stabilizers.....New bulletin covers description, chemical composition, specification & recommended uses for Stabelan Liquid Stabilizers #110, #115, and #120. Request Bulletin 15-29-1-2-56.
414A Harwick Standard Chem. Co.

Zinc Nitrate, Technical.....Baker Zinc Nitrate, Tech. in thin flat flakes . . . faster dissolving, uniform purity—lot after lot, controlled water of hydration, easier to handle. Request samples & prices.
77b *J. T. Baker Chem. Co.

Construction Materials

Castings.....Haynes' investment-casting process is used to improve product design, solve difficult fabricating problems & make important savings in production costs. Refer to "Haynes' Investment-Casting."
414B Haynes Stellite Co.

Castings, Steel.....'Recommended Practice for the Welding of Steel Castings" covers welding methods, electrodes & recommended welding procedure for carbon-steel & low-alloy steel castings.
414C Tempil Corp.

Cement Sheets, Asbestos.....J-M Asbestosite combines these advantages: weather resistant; fireproof; fights corrosion; cuts maintenance costs; permanent as stone. Request brochures IN-121A & IN-173A.
129 *Johns-Manville Co.

Coating Systems, Protective.....New Uclon coating systems give chemical engineers effective weapons against corrosion. Systems based on neoprene coatings for air dry or force dry application. Bulletin No. MC-9.
86a *Metal & Thermit Corp.

Coatings, Ceramic....Announces the publication of a 4 p. bulletin on Molcote, new metallized ceramic coating for use with all types of hard solders. For further details, request descriptive Bulletin 1155.
414D Frenchtown Porcelain Co.

Coatings, Protective.....For any equipment or surface that can be uniformly baked . . . Plastisol compounds offer easy, economical way to apply long-lasting vinyl coating protection. Data in Bulletin No. VP-1.
86b *Metal & Thermit Corp.

Coatings, Protective.....Describes Amercoat No. 87—a heavy bodied, high solids vinyl resin coating which can be applied at thicknesses up to 10 mils in one coat. General physical & chemical properties detailed.
233 *Amercoat Corp.

Coatings, Protectives.....A polyethylene tape coating for corrosion-control on fittings & irregular shaped contours. Polyken No. 940 is designed for use on ells, valves & fittings. Request complete details.
414E Kendall Co.

Covers, Valve & Flange.....Indicating "Spray-Stops" give vivid color-change warning of leaks in either acid or caustic application. Also offer teflon covers for high temperature lines. See illustrated bulletins.
B434 *Neirad Industries.

Fabrication.....Foster Wheeler's exceptional facilities for heavy fabrication can solve your toughest forming, machining and welding problems. Details on fabricating facilities in Bull. GS-56-4.
94 *Foster Wheeler Corp.

Foil, Metal.....AMF introduces electrically insulated metal foil. "Amfoil" is used principally in sub-miniature capacitors, coil forms, transformers, shielding, and flexible packaging. Request complete details.
414F American Mach. & Foundry Co.

*From advertisement, this issue

Insulation.....In addition to corrosion data and information on new metals, this new insulation manual describes and illustrates the company's complete line of equipment and supplies. "New Insulation Manual."
415A A. J. Gerrard & Co.

Insulation, Cellular Glass.....Gives you the maintenance-free insulating performance you need for your piping, tanks, spheres and other industrial equipment. Request product booklets & "Foamglas" sample.
251 *Pittsburgh Corning Corp.

Insulation, Glass Fiber.....Versatile and efficient Ultralite features numerous advantages as insulation for all types of large heated equipment. Request "How-To-Do-It" details and specifications.
285 *Gustin-Bacon Mfg. Co.

Insulation, Industrial.....No matter where your insulation job may be—Armstrong can give you efficient, well-integrated, on-the-job service from original specs to final installations. Booklets describe full line.
223 *Armstrong Cork Co.

Insulation, Pipe.....Amosite . . . the South African asbestos with long, strong, resilient fibers gives Unibestos pipe insulation greater strength and superior insulating ability. Information in Bulletin No. 109C.
306 *Union Asbestos & Rubber Co.

Laminates, Plastic.....8 p. brochure discusses complete range of new industrial & decorative plastic laminates offered by Farley & Loetscher. For details on "Farlite" laminates, request Folder No. 1933.
415B Farley & Loetscher Mfg. Co.

Lead.....In contact with many highly corrosive chemicals, including chromic, sulfuric, sulfurous and phosphoric acids, lead reacts instantly to form an adherent and insoluble surface film. See Lead Handbook.
344 *Federated Metals Div.

Linings, Drum.....Unichrome drum linings deliver resilient, seam-free, pore-free protection against such materials as acids, alkalies, salt solutions, alcohols, detergents, etc. Request descriptive Bulletin No. DL-2.
86e *Metal & Thermit Corp.

Linings & Tile Tanks.....Designed & installed to meet the exact chemical & physical requirements of each installation, Stebbins linings & tile tanks are famous for their efficiency & economy. Request Bulletin A-153.
424 *Stebbins Engrg. & Mfg. Co.

Materials of Construction.....Atlas offers technical advice, engineering and design assistance, highest quality corrosion proof materials and construction services. For complete details, request Bulletin CC#3.
327 *Atlas Mineral Prods. Co.

Plastics.....'"The ABC's of Modern Plastics" is an illustrated booklet containing basic facts on the sources and production of plastics & their growth and importance today. Copies are available on request.
415C Bakelite Co.

Plastics.....The reinforced plastic reported on is "Polyglas", an electrically non-conductive, lightweight, and strong material that is low in cost and easy to install. Request a copy of Bulletin No. 56.
415D Modular Plastic Corp.

*From advertisement, this issue

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Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the product.

we will gladly carry out Hydride

REDUCTIONS *and* **CONDENSATIONS** *for you!*

You can enjoy all the profitable advantages of hydride reductions or condensations without investing in new equipment, tying up facilities or altering production techniques. It's as easy as this: ship your material to Metal Hydrides Incorporated and have us carry out the reduction or condensation for you. Our service accomplished, we return the processed material promptly.

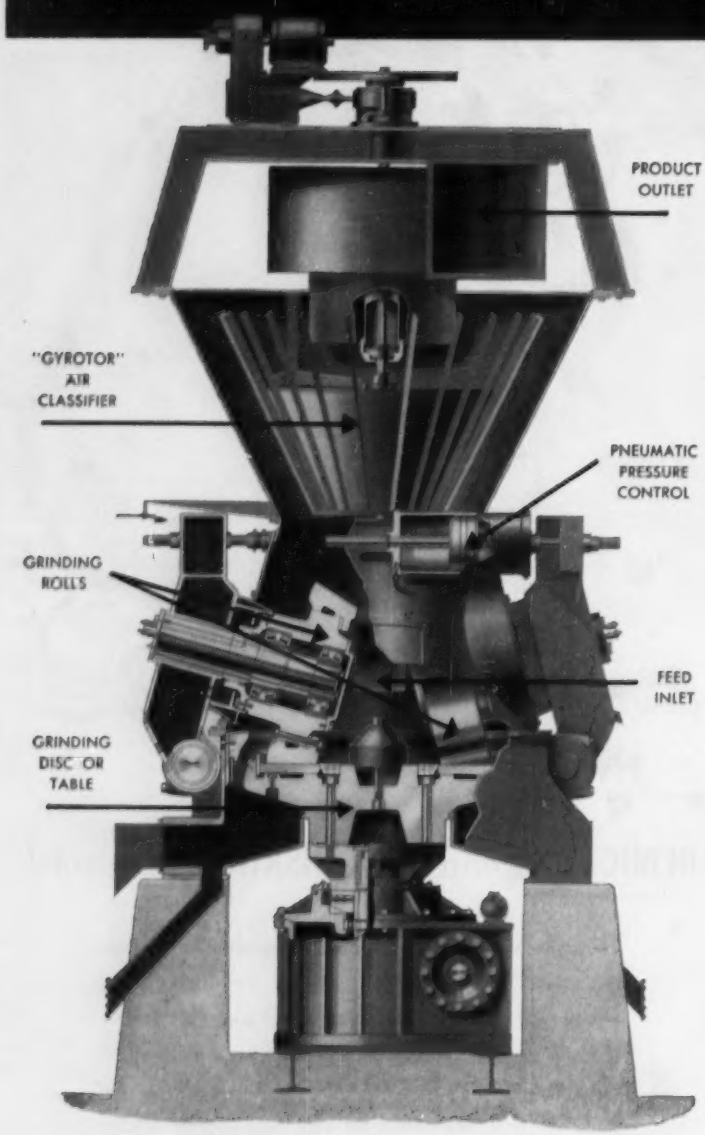
We call this service *Custom Reduction and Condensation.* Full information is yours without obligation; write today!

Pioneers in Hydrogen Compounds

MH **Metal Hydrides** INCORPORATED

CONGRESS STREET, BEVERLY, MASSACHUSETTS

DISC-ROLL MILL



The Hardinge Disc-Roll Mill is a roller-type mill with two adjustable, pneumatically loaded rolls for grinding material on a horizontal rotating disc or table (Loesche type). The Hardinge "Gyrotor" Air Classifier, in combination with the mill, provides a complete grinding, classifying, and drying system. A full description is given in Bulletin 52-11

HARDINGE
COMPANY, INCORPORATED

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LITERATURE . . .

Plastics, Ferromagnetic.....New set of bulletins describe Ferrotron ferromagnetic plastic materials, both in rod and tape and rigid powdered cores. Physical & magnetic properties presented in graph form.
416A Polypenco, Inc.

Refractories.....New bi-monthly leaflet tells more about Carborundum's refractories. Makes liberal use of pictures, charts and tables to explain basic points. Request a copy of Vol. 1, No. 1.
416B Carborundum Co.

Refractories....."Refractories for the Chemical Processing Industries" discusses the selection of refractories and gives a brief description of Harbison-Walker refractories. This bulletin is available on request.
416C Harbison-Walker Refractories.

Refractories....."Refractories in the Iron and Steel Industry" discusses available refractories, their manufacture, properties, service conditions and applications. Copies are available on request.
416D Harbison-Walker Refractories.

Steels, RubberLined.....Ace rubberlined steel . . . strength & pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, many organic acids, etc. Bulletin CE-52.
333b *American Hard Rubber Co.

Tantalum.....Tantalum is immune to hydrochloric acid, nitric acid, bromine, iodine, chlorine and many others. It is strong, immune to thermal shock, unequalled in heat transfer efficiency. See Tantalum Booklet.
418 *Fansteel Metallurgical Corp.

Wire Products....."The Cambridge Wire," published quarterly, gives news of latest developments and applications of woven wire products. Also offers lit. on conveyor belts, wire cloth & fabrications.
416E Cambridge Wire Cloth Co.

Wire Rope.....New 24 p. bulletin gives wire rope recommendations for industrial services. Eech recommendation covers such points as rope diameters, construction, grade & core. Bulletin DH-129D.
416F American Chain & Cable Co.

Electrical & Mechanical

Casters & Wheels.....Featuring Darnel-loprene treads (a soft resilient Neoprene rubber compound) . . . casters offer ease of movement, quietness, and protection for floors. Manual contains complete information.
L421 *Darnell Corp.

Drives.....Available 1-75 H. P. for all service classes . . . horizontal, vertical, and vertical extended with foot or flange mounting. Company makes new "Line-O-Motor" Catalog available on request.
60 *Foote Bros.

*From advertisement, this issue

Keeping too busy?

You'll find our streamlined Reader Service section right up your alley. It's designed for busy engineers who want to find things fast, get more information fast. RS is easy to use, and you can bank on it.

PUMP STUFFING BOXES

INFORMATION suggesting solution of common stuffing box difficulties; available in newly revised BULLETIN S-147

Fig. 19,488

Number of rings, depth of box, type of packing . . . chemical and physical properties of the fluid being pumped, speed of shaft and other pertinent usable facts are in this Bulletin.

WRITE on business stationery for your copy of Bulletin S-147.

TABER PUMP CO. (Est. 1859)
294 ELM ST. • BUFFALO 3, N. Y.

Fig. 6041

TABER

Drives.....Offers a bulletin on the operation and maintenance of the Pfaudler PW drive for agitators used in chemical processing. Gives tips on motor installation & maintenance. See Bulletin No. 931.
417A Pfaudler Co.

Drives, Belt.....The Little Giant Agitator Drive Unit is useful in any application where liquids must be stirred or agitated slowly and positively, and where there must be no contamination. Request details.
417B Little Giant Products.

Drives, Shaft-Mounted.....These versatile, speed-reducing units save space, power, material, and time. Includes selection, application, and dimension details in the new, completely illustrated, engineering Bulletin.
167 *Falk Corp.

Drives, Silent Chain.....88 p. brochure offers detailed engineering data. Covers design and application information, drive components and accessories, operational and technical data, etc. Request Book No. 2425.
87 *Link-Belt Co.

Drives, Variable Speed.....Booklet includes selection tables for A, B, C & D section variable speed drives, information on design features, drive principles, and accessory equipment. Bulletin 20P50.
417C Allis-Chalmers Mfg. Co.

Drives, Variable Speed.....The U. S. Varidyne system is extremely easy to install & affords a practically unlimited selection of Varidyne motor types. For more complete information, request Bulletin F-1910.
417D .. U. S. Elecl. Motors.

Fasteners.....New revised 30 p. catalog carries tables showing size ranges and specifications such as number of threads per inch and length. Request your copy of the revised Unbrako Standards catalog.
417E Standard Pressed Steel Co.

Gaskets.....Garlock 662 gasket material . . . cuts easily, and gaskets will not change shape or shrink in storage under varying climatic conditions. Withstands temperatures up to 300°F. For details, see Bulletin AD 146.
361 *Garlock Packing Co.

Generating Plants.....New 8 p. catalog is designed to make it easy for the reader to select the proper type of generating plant and necessary accessories with a minimum of effort. Catalog A-428.
417F D. W. Onan & Sons.

Motor Bases.....New V-belt drive motor base automatically compensates for belt stress and tension. This substantially reduces wear on both belts and bearings. Request information, including Bulletin 1300.
417G Lovejoy Flexible Coupling Co.

Motors.....Choosing a Century motor, Performance-Rated to fit your particular job, is merely a matter of minutes when you use company's handy Application Guide. For your free copy, request Form No. 1700.
297 *Century Elec. Co.

Motors, Flat-Type.....Full horsepower in less space, reduced weight, standard radial construction, easy to disassemble and reassemble, no precision alignments or complicated air-gap adjustments. Bulletin CE-3461.
153 *Diehl Manufacturing Co.

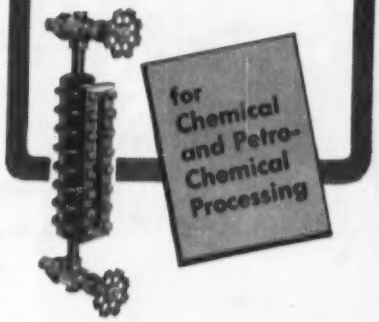
Motors, Gear....."Reduce Speed" describes new line of Reliance Gearmotors . . . the first line of gearmotors available incorporating new NEMA motors and completely redesigned gearheads. Bulletin E-2408.
97 *Reliance Elec. & Engrg. Co.

Motors, Varidrive.....With a U. S. Varidrive motor you can get instantly all the speeds needed for every operating condition. For a complete informative full color reference, request Booklet No. 1797.
54 *U. S. Elecl. Motors.

*From advertisement, this issue

At Jerguson you get a

Complete Line of Liquid Level Gages, Valves and Specialties



Working closely with the men in the field, Jerguson has developed a complete line of specialized gages, valves and other equipment to meet the specific needs of the chemical and petrochemical industries for the observation of liquids and levels. Available in stainless, monel, nickel, hastelloy and many other materials . . . with rubber, neoprene, lead, teflon, Kel-F, and other linings . . . in a variety of end, side or back connections.

Reflex and Transparent. With a variety of valves for all installations.

Large Chamber Gages. Minimize boiling and surging effect. Both Reflex and Transparent; also with non-frosting gage glass extension.

Heated and Cooled Gages and Valves. Complete line of heated and cooled gages and valves, in various models, both Reflex and Transparent.

Non-Frosting Gages. Patented design prevents frost building up over vision slot.

Welding Pad Gages. Weld right to liquid containing structure and become an integral part of it. Can be staggered for continuous visibility.

Illuminators. Explosion-proof construction, UL approved.

Group G Instrument Piping Valves. Unions, nipples, reducers, elbows, tees, valve and bleed valve all combined in one space-saving unit.

Write for Data on Jerguson Products for Chemical and Petrochemical Processing.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Trees Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

TANTALUM... We recommend it only when it is the cheapest material AVAILABLE

Tantalum is seldom cheaper on a "per-pound" basis. But tantalum is quite often the "cheapest" material when judged on an over-all final operating cost basis, on a product purity basis, on a freedom from maintenance or an elimination of down-time basis.

We don't expect anyone to take tantalum on faith or generalities. But if you process hydrochloric acid, nitric acid, perchloric acid, bromine, iodine, hydrogen peroxide, sulfuric acid, chlorine, chlorine dioxide (and many other corrosives), tantalum may save you money. Fansteel engineers can tell you, definitely, whether or not tantalum will be "cheapest" for you.

USE TANTALUM WITH ECONOMY for most acid solutions and corrosive gases or vapors.

Not recommended for HF, strong alkalis or substances containing free SO_3.

Write for free TANTALUM booklet today!

FANSTEEL METALLURGICAL CORPORATION
Chemical Equipment Division
NORTH CHICAGO, ILLINOIS, U.S.A.

G563A

LITERATURE . . .

Rectifiers.....A new revised edition of Bart-Messing's "guide" to power conversion rectifiers is now available. Includes photographs of all sizes & styles of rectifiers. "A Guide to Better Plating Power."
418A Bart-Messing Corp.

Reducers, Vertical Speed.....The unique single casing and bolted-on motor construction makes mounting and installation simple and it eliminates base plates and couplings. For details on MotoReducer—Cat. MR-54.
R421 *Philadelphia Gear Wks.

Relays, Precision.....New bulletin gives features, description, design specifications, operating specifications and ordering information for precision relays used in high & low limit action. Bulletin MRM240.
418B Manning, Maxwell & Moore.

Seals, Mechanical.....Reduce your liquid handling costs with types 1 & 2 to type 9 seal, that can be adapted to your individual conditions. Company offers information in its Seal Catalog.
329 *Crane Packing Co.

Seals, Mechanical, Rotary.....Company announces the availability of a new 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. Illustrated Bulletin B-111.
127h *Mixing Equipment Co.

Seals, Shaft.....Teflon wedge shaped sealing member is impervious to chemicals and solvents—permits high temperature service to 500°F. For complete details on the Type 9 Shaft Seal, request Bulletin S-205-2.
418C Crane Packing Co.

Starters, Magnetic Motor.....Starters feature "Three Star Motor Control" quality, improved pressure type terminals, exclusive visual or audible alarm circuit & plastic-covered coil insulation. Publ. EE-191.
418D Cutler-Hammer, Inc.

Tools & Wrenches.....Contribute greater efficiency to assembly and maintenance operations by using Snap-On tools. For complete data request free catalog of industrial wrenches and hand tools. Yours for the asking.
362 *Snap-On Tools Corp.

Transformers, Variable.....New Powerstat variable transformers, types 136 & 236, offer new design, new ratings and new performance. Bulletin discusses new features and includes a price list. See Bulletin P354.
418E Superior Elec. Co.

Transmission Equipment.....New engineering catalog covers the complete line of Dodge mechanical power transmission products. Includes sectional drawings, dimensions, weights, prices & applications.
418F Dodge Mfg. Corp.

Transmission Systems.....16 p. bulletin describes the versatility of the Orthoflow system for transmission of flow data, liquid level data, or pressure measurement data. For details, see Bulletin No. 700.
418G Simplex Valve & Meter Co.

Turbines, Mechanical Drive.....High speed mechanical drive turbines, operating at speeds ranging up to 10,000 rpm and above, are described in a new bulletin. For complete details, request Bulletin GEA-6232.
418H General Elec. Co.

*From advertisement, this issue

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USED IN REFINERIES AND CHEMICAL PLANTS THROUGHOUT THE WORLD

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LITERATURE . . .

Turbines, Solid-Wheel.....Feature reliable, trouble-free operation. Rugged construction and superior design result in savings by keeping maintenance costs down to a minimum. Full details in Bulletin No. S-116.
84 *Terry Steam Turbine Co.

Handling & Packaging

Belting.....New 4 p. bulletin released on Lightweight Neoprene Belting. This belting, used for conveying, elevating & power transmission, is available in 4 styles with specific widths & lengths. Bul. 561.
419A General Rubber Corp.

Belts, Conveyor, Woven Wire.....Presents a 130 p. Reference Manual illustrating and describing company's woven wire conveyor belts. Also special report, "9 Ways to Speed Production in Rubber Processing."
349 *Cambridge Wire Cloth Co.

Converters, Ammonia, Portable.....In addition to speed, ease of operation and ready access to all operating parts are important features of the design of the Carlile portable ammonia converter. Request details.
419B J. C. Carlile Corp.

Conveying Systems, Cooling.....New line of cooling and conveying systems, to meet the increasing demand for cooling powdered products before packaging. Request details on these compact pneumatic systems.
419C Henszey Co.

Conveyors.....In any industry wherever dry bulk materials are used . . . the introduction of Airstream conveyors invariably leads to lower-cost materials handling. For full details, request 24 p. Bulletin 529.
144 *Dracco Corp.

Conveyors.....Handle packages, parts, units—faster—at reduced cost with gravity or power roller, belt, slat, chain, wheel or push-bar conveyors. Specifications, drawing & application data in Bulletin No. 309.
422 *Standard Conveyor Co.

Conveyors, Fluidizing.....The F-H Airslide fluidizing conveyor offers simplicity and noiseless ease in conveying alumina, phosphate, cement, flour, filler dust and other dry, fine materials. Descriptive literature.
236 *Fuller Co.

Conveyors, Screen.....IMCO Balanced Screen Conveyors permit the lowest initial investment costs possible for any screening or conveying operation. Designed for smooth, easy operation. Request details.
419D Williams & Green.

Cranes, Jib.....Introduces first power-rotated jib crane with lifting capacities up to 15 tons. Big loads are handled easily with electric-powered, self-supporting jib crane. See Form No. 714-1-6.
419E R. G. LeTournear, Inc.

Feeders.....Outstanding features of the Lapp "Auto-Pneumatic" Pulsafeeder make possible continuous automatic processing of liquids which cannot be satisfactorily handled by plunger-type metering pumps. Bul. 400.
235 *Lapp Insulator Co.

Feeders.....Prater offers Blow-Thru Feeder for pneumatic systems. Available in cast iron and bronze. Power requirements vary according to the fineness and abrasiveness of the product. New Airlock Catalog.
366 *Prater Pulverizer Co.

Feeders, Flush.....With check-valve difficulties minimized & erosion eliminated, an extremely broad range of slurry solutions or corrosive liquids can be handled by this flushfeeder. Request complete information.
419F Proportioneers, Inc.

*From advertisement, this issue

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ANTIFOAM A — KILLS FOAM IN 160,000 lb coumarone-indene resin

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ANTIFOAM AF EMULSION — KILLS FOAM IN 15,625 lb dill pickle processing solution

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Pumping Progress Report

FOR CHEMICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

PUMP INSPECTION, MAINTENANCE AND REPAIR are jobs too frequently ignored in the design of production pumps. This has been verified by a survey of more than 15,000 pump installations. Speed and economy of maintenance was frequently quoted as a major factor in pump selection.

SECTIONALIZED FLUID-ENDS offer one of the best ways to guarantee both speed and economy in pump maintenance. As originated by ALDRICH Pump Co. Engineers, the Sectionalized Fluid-End comprises four main assemblies — the working barrel, suction manifold, discharge manifold and stuffing box.

SPEED IN MAINTENANCE is assured because of ease of accessibility of all wearing parts. Manifolds can be slid back on studs and valves removed as complete units. Split collar and flange connection of plunger to yoke permits easy removal of plunger.

ECONOMY OF MAINTENANCE results from speed in maintenance. Perhaps even more important is the simple fact that it is cheaper to replace a single section than a complete fluid-end. Another important economy is parts interchangeability. Among 3-, 5-, 7- and 9-plunger units of any series, wearing parts are interchangeable. Where a combination of multiplex pumps is required, this reduces spare parts stocks.

THE ALDRICH PUMP COMPANY is the originator of the DIRECT FLOW principle — a design innovation that utilizes the sectionalized fluid-end principle. Aldrich Engineers have become known as the people to take your tough pumping problems to. We have never turned down a challenge.

FURTHER INFORMATION can be had direct from the company. Tell us your problem and we'll send you Data Sheets describing the size pump we recommend to solve your problem. Address your request to: The Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

LITERATURE . . .

Handling & Packaging.....Articles on latest money-saving developments in handling lumber, unitizing brick & tying forms in concrete construction appear in the Spring 1956 issue of "The Signode Seal."
420A Signode Steel Strapping Co.

Loaders.....Company announces the introduction of the TL-11 Tracto-Loader. It has front wheel drive for better traction and is equipped with rear wheel power steering. Request more complete information.
420B Tractomotive Corp.

Magnets.....Covers newly designed line of non-electric Alnico Perma-Plate Magnets which incorporate an entirely new concept of tramp iron removal by the "Dynamic" principle of magnetic attraction. Catalog 1205-D.
407 *Dings Magnetic Separator Co.

Packaging Machines..... Whiz-Packer Volumetric Filler with Horizontal Feed is designed to minimize breakage & tolerance in a broad range of products, yet handle with a maximum of speed. See equipment report.
420C Frazier & Son.

Platforms, Work.....New hydraulic lift work platform provides high standards of safety and convenience for average work levels up to 15 feet. Request additional information on Ballymore Platforms.
420D Ballymore Co.

Ramps, Bridge.....A new improvement called the free floating retractable stop has been made on the One Man Bridge Ramp. Eliminates breakage or bending of ramp's locking device and stops. Request details.
420E Elizabeth Iron Works.

Tanks, Weighing.....Automatic weighing tanks, widely used in the agricultural chemical industry, have now been adapted to the liquid chemical field. Measure by weight rather than by volume. Details on request.
420F Davidson-Kennedy Co.

Trippers, Conveyors, Belt.....Company announces a new, belt conveyor tripper accommodating long center roll, deep-troughing idlers for use with belt conveyors handling light materials. See Bulletin 156.
420G Stephens-Adamson Mfg. Co.

Trucks, Fork.....New electric powered trucks are specifically designed for use where low headroom is a problem. No sacrifice of operator visibility & no change in operating efficiency. Request details.
420H Elwell-Parker Electric Co.

Trucks, Low-Lift.....Low-lift Model "M" rider type trucks are available in both the pallet type for handling single face or double face pallets & the platform type for skid platforms. Circular 35F.
420I Lewis-Shepard Prods.

Trucks, Walkie.....This new truck is powered by four conventional automotive type batteries, connected in series to provide 24 volt operation for ramps & high speed travel on long hauls. Request Bulletin No. 910.
420J Raymond Corp.

*From advertisement, this issue

Keeping too busy?

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Note these features:

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

RUST-PROOFED . . . by zinc plating, Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Zerk fittings are provided for quick grease-gun lubrication.

STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

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40 WALKER STREET, NEW YORK 13, NEW YORK
36 NORTH CLINTON STREET, CHICAGO 6, ILLINOIS

LITERATURE . . .

Unloading, Tank Cars, Liquid Chemicals .....Covers: aqueous ammonia; lime sulfur solution; sodium silicate solution; & sodium sulfide, liquid. See "Unloading 'Non-Regulatory' Liquid Chemicals from Tank Cars."
113e *General Chem. Div.

Unloading, Tank Cars, Rubber-Lined..... The following chemicals are covered: liquid alum; aluminum chloride; muriatic acid; and phosphoric acid. For details, see "Unloading Rubber-Lined Tank Cars."
113b *General Chem. Div.

Unloading, Tank Cars, Steel.....Chemicals covered: electrolyte; hydrofluoric acid; mixed acid or nitrating acid; oleum; spent acid; sulfuric acid; & fluosulfonic acid. See "Unloading Steel Tank Cars."
113a *General Chem. Div.

Weight Control.....Through Toledo's electronics system of remote data handling, weight data is no longer limited as to form, or close proximity to the point of origin. Bulletin on new remote digital weights.
355 *Toledo Scale Co.

Heating & Cooling

Burners.....New series of Rotary oil burners all have integral air registers. They range in size from 9 g.p.h. to 125 g.p.h. and are exceptionally easy to install. Request spec. sheets & tech. data.
421A Iron Fireman Mfg. Co.

Cables, Heating.....Bulletin contains product, application, and installation information and collateral data to help in the selection and installation of heating cable for any specific job. Publication No. 19-675.
421B General Elec. Co.

Coils, Heating & Cooling.....Stainless—Continuous plate type with staggered tubes and smooth drawn ferrules pressure-expanded to produce effective positive mechanical and thermal bond between tube & fin. Details.
309b *Mario Coil Co.

Condensers, Evaporative.....Stainless—3—150 tons. Suitable for indoor or outdoor location. Quiet operating. All prime surface condensing coil. Available to your specifications. Request further information.
309d *Mario Coil Co.

Coolers, Cascade.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Catalog Section No. S-6820.
157f *National Carbon Co.

Dehumidification.....'Facts About Dehumidification for Industrial Plants, Warehouses, Stockrooms and Laboratories and Home Requirements" answers your questions and shows the latest equipment in this line.
421C Abbeon Supply Co.

Dryer-Coolers, Rotary.....This versatile equipment is particularly applicable in drying or cooling heavy or high moisture content materials. Dries with parallel flow and cools with counterflow. Request data.
35-40b *Allis-Chalmers Mfg. Co.

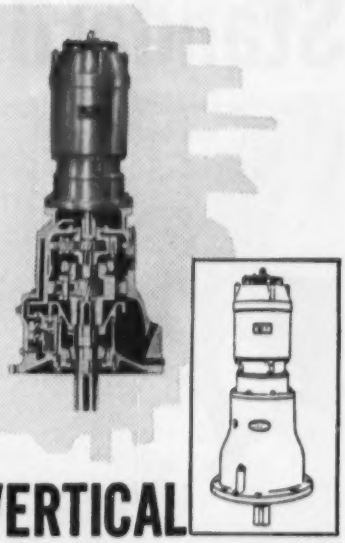
Furnaces.....The Blaw-Knox Radiant Furnace is a newly designed unit for rapid precision heating of heat-sensitive materials. It is designed for gas or oil firing. Request Reference Files 2-2.1 & 2-2.2.
421D Blaw-Knox Co.

Furnaces.....The Water-wall furnace brings these advantages to existing boilers: improved circulating characteristics; improved life expectancy; 50% increased boiler capacity; 10% improved efficiency. Request details.
421E Preferred Utilities Mfg. Corp.

* From advertisement, this issue

Philadelphia

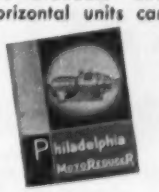
MOTOREDUCER



VERTICAL SHAFT DRIVE

For a compact, neat and sturdy self-contained Vertical Speed Reducer, the Philadelphia **MotoReduceR** is tops in design, construction and operation. The unique single casing and bolted-on motor construction . . . makes mounting and installation very simple, and of course, it eliminates base plates and couplings. The planetary, in-line reduction gears provide a rugged drive capable of withstanding severe overload conditions . . . Other features are: wide bearing span, permitting use of long, unsupported vertical shafts; Exclusive "dry-well" construction, which prevents oil leaking down output shaft.

Philadelphia MotoReduceRs can be supplied for output speeds from 9 R.P.M. to 420 R.P.M. with standard motor speeds . . . Units up to 100 H.P. are available—and a full range of horizontal units can also be supplied.



For complete information, send for 32 page Catalog MR-54

phillie gear

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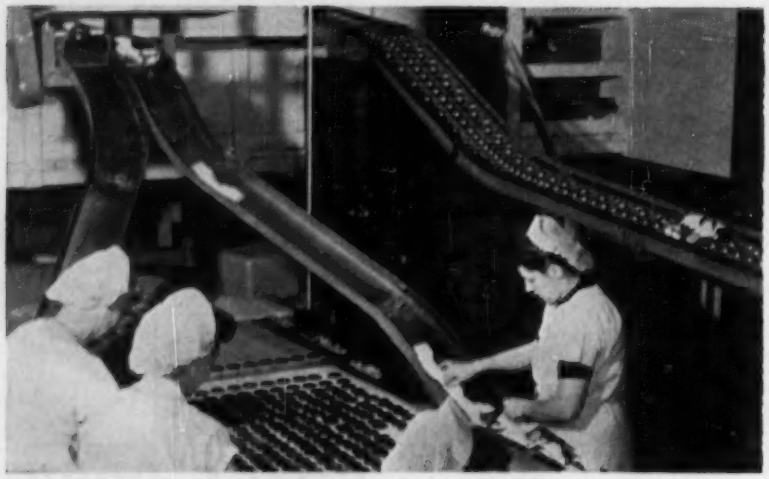
INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS · FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

Ask Standard ... how to cut costs with conveyors



Chutes carry empty trays from makeup machine to packing belts alongside the cookie enrobing line.

Trays are filled with cookies as they move past operators to automatic wrapping and packaging.

Floor-to-floor conveyors save manhours, space, handling

for famous biscuit and cookie maker

A VARIETY of conveyor equipment makes this system a model of simplicity, efficiency, economy.

It's another example how Standard's experience in conveyor application pays off. At Robert A. Johnston Company, Milwaukee, Wisconsin, Standard Conveyors pay for themselves in manhour savings . . . eliminate most hand trucking . . . cut floor area needed for handling by two-thirds.

STANDARD CONVEYOR COMPANY, General Office: North St. Paul 9 Minn. Sales and Service in Principal Cities. *Canada*: International Equipment Co., Ltd.

Left: 3-tier power and gravity system carries cases to warehouse. Tape-sealing and coding of cases are done on roller conveyor lines. Right: Multiple spiral chutes lower cased goods from 4th to 1st floor. Speed is controlled by pitch design.

For details, see the Standard Engineer listed in the phone book or write for Bulletin 309. Address Dept. 6-7

Sales and Service in Principal Cities.

LITERATURE . . .

Furnaces, Industrial.....New catalog describes standard and special furnaces to 3000°F in several series, ovens & furnaces with silicon-carbide heating elements. See "Industrial Furnaces & Ovens."
422A L & L Mfg. Co.

Generators, Steam.....16 p. book gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings & installation photos on new series of steam generators. Bulletin PG-55-3.
83 *Foster Wheeler Corp.

Generators, Steam.....Compact marine steam generator delivers 5000# steam/hr. in ½ space. Boiler is designed to modulate over a wide range with high efficiency. Request complete information.
422B Cyclotherm.

Heat Exchangers.....New bulletin contains data & illustrations of interest to designers & users of custom-built heat transfer equipment. Describes a number of available heat exchanger types. Request Bulletin HE.
14 *Downingtown Iron Works.

Heat Exchangers.....New Alcotwin heat exchangers give "building block" flexibility, unequalled heat transfer. They provide economical, high performance in package form. For complete details, request brochure.
160 *Alco Products.

Heat Exchangers.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.
157d *National Carbon Co.

Heat Exchangers.....Covers complete line of Karbate brand impervious graphite shell & tube heat exchangers. Engineered for maximum corrosion resistance & minimum maintenance. Catalog Section No. S-6800.
157e *National Carbon Co.

Heat Exchangers.....Aero heat exchanger cools liquids & gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. Data in Bulletins 120 & 124.
408 *Niagara Blower Co.

Heat Exchangers.....New Young stainless steel heat exchangers offer greater initial & operating economies for heating or cooling liquids & gases used in the processing industries. Request illustrated Catalog.
414 *Young Radiator Co.

Heat Exchangers.....New 18 p. brochure includes: a description of the design specifications & construction details of these standard units; tables of overall dimensions; thermal design data. Bulletin No. M-306.
422C Lummus Co.

Heat Transfer Apparatus.....Votator heat transfer apparatus can improve efficiency and product quality in numerous processes. Company makes available a Heat Transfer Data Book containing complete information.
2 *Girdler Co.

Heaters, Immersion.....The versatile ThermX "QT" Heater is ideal for use in both small plating tanks and in an independent series in large tank installations. Replace worn-out elements with ease. Request details.
422D N. J. Thermex Co.

Heaters, Paint.....Accurate for precise temperature control; efficient for large or small operations; fool-proof and maintenance free; simple and economical to operate. For details, request Form No. 1E-114-B.
422E DeVilbiss Co.

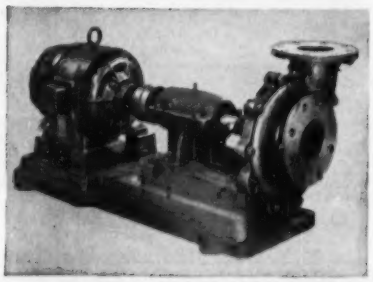
Heaters, Screen.....Hanco electric screen heaters are used in industry for the efficient heating of wire screens by electricity. For complete details, request "The Key to Successful Screen Heating."
422F F. R. Hannon & Sons.

* From advertisement, this issue

MOVING LIQUIDS?

YOU CAN DEPEND ON

Frederick



SSV PUMPS

for most efficient, carefree service!

CHECK THESE FEATURES

- Single stage, single end suction—with enclosed or open impeller.
- 1" to 4" discharge openings; heads up to 220 feet; operating speed—1750 rpm.
- One piece impellers, secured to shaft by key and lock nut, or threaded, give long service.
- Flanged suction and discharge openings mean easier connecting and disconnecting of joints.
- Vertically split pump casing and horizontally split bearing housing give maximum accessibility for maintenance.
- Extra large stuffing box, or mechanical seal—both provide minimum leakage.

Enclosed impeller types for chemicals, oils, juices, clear liquids, acids, etc. Open impeller types for slurries, brewery mash, food mash, white water, paper stock up to 2% consistency, etc. Constructed of metals to meet *your* requirements—cast iron, nickel, stainless steel, monel, etc. Send your requirements to our skilled staff for suggestions. Ask for free copy of Bulletin 107.

FREDERICK PUMPS

FREDERICK IRON AND STEEL, INC.

FREDERICK *Est. 1890* MARYLAND

LITERATURE . . .

Heating Systems, Dowtherm.....Furnishes descriptive information on Dowtherm heating systems for processes requiring precision control of high constant temperatures at low pressures, in Bulletin ID-54-5.
135 *Foster-Wheeler Corp.

Refrigeration Products.....Preassembled refrigeration parts of aluminum eliminate heliarc welding & assembly operations, save process handling operations, improve production line efficiency, save time & money.
423A Wolverine Tube Div.

Tandem Combustion Units, Oil-Gas..... You will realize higher profits from your heaters when National Airoil vertical or horizontal tandem units are specified. For full details, request Bulletin 498.
R431 *National Airoil Burner Co.

Towers, Cooling.....Announces new line of Flow-Mizer cooling towers in capacities from 15 through 100 tons. Features stepped-up capacities and increased efficiency with advanced-design Acme-Pak. Request details.
423B Acme Industries.

Towers, Cooling.....FW cooling towers are built of decay-resistant California redwood. The induced-draft counter-flow tower represents an important advance in cooling tower design. Request new Bulletin.
61 *Foster Wheeler Corp.

Towers, Cooling.....12 p. catalog on new "MT" line of heavy duty, quiet operating cooling towers. Covers complete line . . . 23 sizes, from 10 to 400 tons . . . for air conditioning & refrigeration. Bulletin 202.
423C Baltimore Aircoil Co.

Towers, Cooling.....Stainless—2—150 tons. Suitable for indoor or outdoor location. Quiet operating. Marlo heat transfer equipment now available to your specifications. Request further information.
309c *Marlo Coil Co.

Towers, Cooling.....Pritchard Cooling Tower framework is a big step in cooling tower design. "Answers to the 15 Questions About Pritchard Induced Draft Cooling Towers" furnishes valuable tips.
336-7 *J. F. Pritchard & Co.

Traps, Steam.....Give faster, more effective condensate removal. Powerful valve action, positive shut-off, high capacity & each unit service tested. For more details, request new Bulletin No. 10-55.
80 *W. H. Nicholson & Co.

Instruments & Controls

Analyzers, Combustible Gas.....Data sheet describes Davis Combustible Gas Analyzers with Brown ElectroniK recorders & controllers. Used for both safety & production application. Data Sheet 10.15-4b.
423D Minneapolis-Honeywell.

Automation Equipment.....New catalog presents products & services offered by "ATC" for the field of Automation. Covers time control equipment, valves, counters, electronic contactors, etc. See Catalog D-31.
423E Automatic Temp. Control.

* From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

EASY DOES IT ...WITH CO_2

SEE HOW CO_2 CAN WORK FOR YOU

Send For Free Booklet "Applications Unlimited"

No other gas works so hard or so well—at so many jobs. These are typical examples of CO_2 at work. For information on scores of other important applications mail the coupon below.

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CO_2 is extensively used in the manufacture of both foam rubber and foam thermoplastics. Among CO_2's most important applications in these fields are its uses as a foaming agent and as a neutralizer.

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In pre-tanning processes, CO_2 is the ideal weak acid for lowering and controlling pH of the skins. Why ideal? The close control required by stronger acids isn't necessary. CO_2 is also far easier and safer to handle.

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Heat harms blood plasma, penicillin and other pharmaceuticals. Yet, for these drugs to be stored efficiently, moisture must go. The answer is CO_2 "freeze drying." CO_2 is fully as effective as other systems, yet capital outlay is minute in comparison.

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There's practically no end to the important jobs that CO_2—combined with LIQUID CARBONIC savvy—is doing. Chances are that this combination can come up with some surprising answers for you, too.

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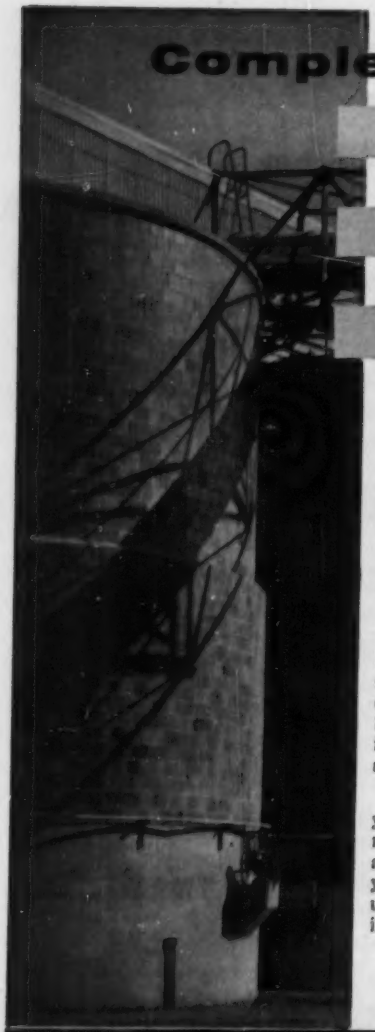


Complete Service

DESIGN
by our own engineering staff

INSTALLATION
by our own construction crews

MAINTENANCE
by our own service specialists

of Non-Metalic
Corrosion-Resistant

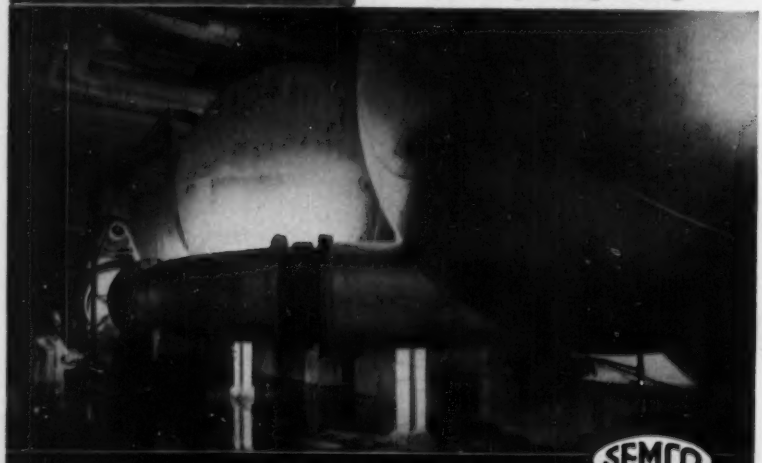
LININGS and TILE TANKS

Designed and installed to meet the exact chemical and physical requirements of each installation, Stebbins linings and tile tanks are industry-famous for their efficiency and economy.

Wherever you are—whatever your corrosion-resistance problem may be (even at high temperature and high pressure)—it will pay you to take advantage of Stebbins' unequalled design experience and installation facilities.

Write for Bulletin A-153

See our Advertisement in
Chemical Engineering Catalog



SEMCO

STEBBINS

Engineering and Manufacturing Company, Watertown, N. Y.

STEBBINS ENGINEERING CORP. — 1504 TOWER BLDG., SEATTLE, WASH.
CANADIAN STEBBINS ENGR. & MFG. CO., LTD. — CASTLE BLDG., MONTREAL, CANADA

SINCE 1884
Specialists in Design, Installation and Servicing of Linings and Tile Tanks

LITERATURE . . .

Comparators.....Fully illustrated, 100 p. tells how to use pH and chlorine control for water supplies, process solutions, production processes in 34 basic industries. Also covers complete line of comparators.
R433 *W. A. Taylor & Co.

Control Systems.....Bulletin describes Fireye primary control System FJ-2 for light oil or gas-fired automatic commercial burners. Contains full operating data. For complete details, see Bulletin CF-21.
424A Electronics Corp. of America.

Control Systems, pH.....L&N pH Control System includes Speedomax recorder, L&N Control Unit, Valve Drive Mechanism, and pH electrode assemblies. Successful approach to waste treatment. Data Sheet 700(2).
158 *Leeds & Northrup Co.

Controllers.....The new Puromatic Controller was designed to control the purity of distilled water automatically. Constantly measures the purity of distilled water before it enters storage tank. Request details.
424B Barnstead Still & Sterilizer.

Controllers, Batching.....The Foxboro batching controller solves temperature "overshot" problems. For batch operations requiring controlled rate of rise, request data on Cam-Set & Time-Cycle controllers.
67 *Foxboro Co.

Controllers, Indicating.....Offers data on new Series 560 controller . . . with revolutionary thermistor principle of operation for kilns, ovens, furnaces, extruding, air heaters, etc. See Catalog No. 500 for details.
55 *Fenwal, Inc.

Controls.....Vest-pocket size . . . recording, indicating and non-indicating explosion-proof controls for use with gas, oil, steam or water valves, or with electrical equipment. —30F to 1200F ranges. Bulletins.
367 *Parlow Corp.

Controls, Temperature.....Improved design remote bulb temperature controls . . . wide Range Type F56 . . . calibrated Type E13. For complete data on the remote type temperature controls, see Catalog Section 200.
375 *United Elec. Controls Co.

Gages.....Announces new line of small-size, easy-to-read gages & receivers. Important features: 5 in. illuminated scales; independent, interchangeable units; easily mounted; etc. Data in Bulletin V5.
74 *Republic Flow Meters Co.

Gages.....For pressure, vacuum or compound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth. Provides complete information in Gage Catalog No. G-2.
339 *Helicoid Gage Div.

Gages, Liquid Level.....Presents valuable data on liquid level gages: reflex; thru vision; tubular. Standard equipment in leading refineries and industrial plants all over the world. Request complete Catalog.
L419 *Strahman Valves.

Indicators, Flow.....New ball-type flow indicator provides a dual scale for the approximate measurement of water flow in gpm and air flow in cfm. Exceptionally versatile for industrial use. Bulletin 18W.
424C Schutte & Koerting Co.

Instruments, Laboratory.....New 8 p. catalog describes Servall laboratory instruments, including angle centrifuges, ultra-microtomes, high-speed homogenizers, gas & moisture testers, etc. Request your copy.
424D Ivan Sorvall, Inc.

Instrumentation, Miniature.....Whenever you're planning graphic process control, plan to take advantage of the extra values built into the latest Tel-O-Set miniature instruments. New Bulletin No. 7202.
46-7 *Minneapolis-Honeywell

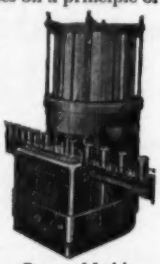
* From advertisement, this issue

VACUFLOW

POWDER FILLERS

Cut Product Wastage. Vacuflow powder filling equipment operates on a principle of vacuum feeding, instead of pressure, to pack powder into a container.

Air is removed from the container to create a vacuum which draws a measured quantity of powder from the hopper. There is no problem with dust control, since the unique Vacuflow method simply does not involve air currents that cause dust.



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Semi-automatic models are available for filling containers ranging from the tiny talcum box up to and including 100 lb. paper bags and 200 lb. drums. Rotary models are available for automatic production of 5 lb. sizes or less at speed of 45 to 300 per minute.

Model E

Pneumatic is the one manufacturer in a position to furnish machines for making up complete production lines. Units are available for air cleaning, powder and liquid filling, capping and labeling a wide range of bottles, cans or jars.

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PNEUMATIC

LITERATURE . . .

Instruments, Process.....2 p. bulletin describes specifications, ranges, dimensions & mounting of the Types HE and HJ process instruments—indicators, recorders, recording controllers. Bulletin GEC-1362A.
425A General Elec. Co.

Instruments, Testing.....New leaflet contains illustrations and brief descriptions of 31 instruments the company makes for testing paper, plastics, textiles, light metals and other materials. Leaflet P-560.
425B Thwing-Albert Instrument Co.

Measurement, Temperature.....The Alnor Pyrocon combines laboratory precision with production tool ruggedness to give you fast, accurate answers to all surface temperature problems. Request Bulletin.
L431 *Illinois Testing Labs.

Meter & Analyzer, Sound Level.....The M-S-A Soundscope combines the functions of sound level meter, octave band analyzer & narrow band analyzer in a single compact unit. Request Bulletin No. 0818-1.
425C Mine Safety Appliances Co.

Meters.....Type 316 stainless steel meter for corrosive liquids . . . is answer to many measurement problems in food, chemical, drug & industrial processing fields—it resists corrosion. Bulletin No. OG-406.
295 *Rockwell Mfg. Co.

Meters, Displacement.....Niagara Meters measure volumetrically. Accurate measurement prevents waste and loss. Liquid formulas can be processed with accuracy insuring greater uniformity of product. Request details.
357 *Buffalo Meter Co.

Meters, Flow.....This vane-type flowmeter is designed for a constant pressure drop across the meter and may be used for indicating, controlling, signal alarm, and similar applications. Request full details.
425D Scully-Jones & Co.

Meters, Fluid.....New bulletin describes Fluidometer automatic metering system for batching light or heavy liquids. Installations of direct control, remote control, dual valve & multivalve systems shown. Bul. FL-56.
BL441a *Hetherington & Berner.

Meters, Positive Displacement.....For measuring gas from 4,000 cfh to a million, you can trust the qualities of R-C Positive Displacement meters. R-C "plur-ability" pays dividends. Details in Bulletin No. M-152.
370e *Roots-Connersville Blower.

Meters, Pump.....This meter pumps a wide variety of fluids over any period of time at low cost. High efficiency & low maintenance features are found in this new Hills-McCannameter. See Bulletin No. 300.
425E Hills-McCanna Co.

Meters, Turbidity Recording.....Bulletin describes features, application, calibration, installation, & operation of the recording turbidimeter. For details on this analytical process instrument, see Bulletin GEC-1203A.
425F General Elec. Co.

Monitors.....New model height-of-fill monitor, an x-ray device that automatically monitors under- and overfills of sealed opaque containers on a conveyor line. Request descriptive lit., Pub. 8A-3441A.
425G General Elec. Co.

* From advertisement, this issue

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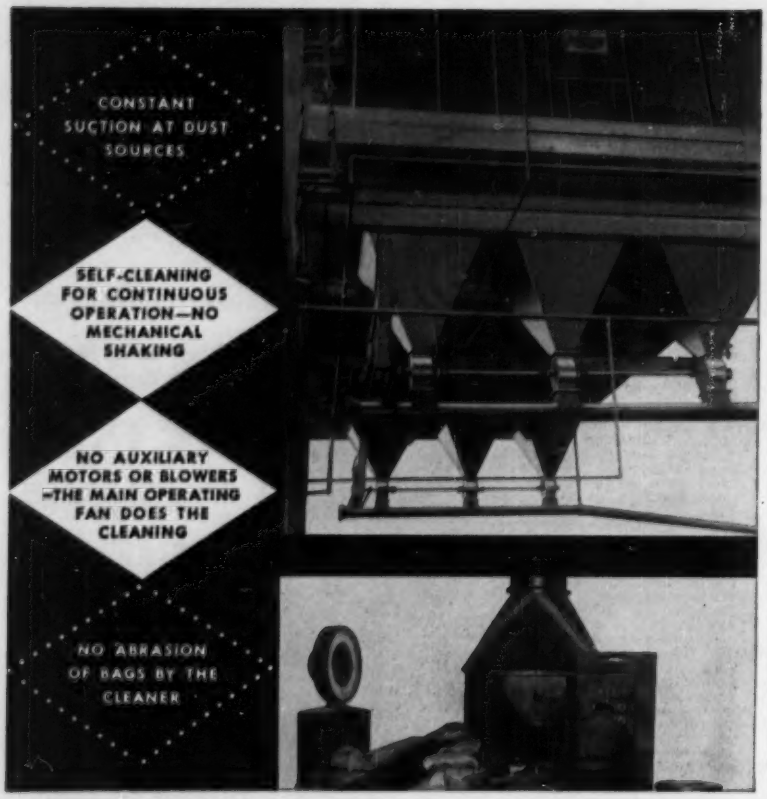
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LITERATURE . . .

Pyrometers & Thermometers . . . . . Describes features, accessories, application, specifications & special calibration of Type HP instruments for temperature indication & control of industrial processe. Bul. GEC-1342A.
426A General Elec. Co.

Recorders. . . . . Offer valuable features: pre-calibrated plug-in receiver units; up to 4 pneumatic or electronic receivers—or 2 receivers & 2 integrators; etc. Products Spec. E12-5 & actual chart sample on request.
*Bailey Meter Co.

Recorders, Temperature. . . . . Newly designed Model "1000" Auto-Lite recorder gives permanent proof of temperature behavior. Request valuable catalog describing the many styles of recorders and indicators.
T347 *Electric Auto-Lite Co.

Refractometers. . . . . The Barnes Differential Refractometer features a sealed optical system, photocell detection, temperature compensation & a null balancing system for maximum accuracy. Request details.
426B Barnes Engrg. Co.

Regulators. . . . . Describes Stabiline automatic voltage regulators (Type IE instantaneous electronic—Type EM electro mechanical) for increased efficiency, peak performance & lower costs. Bulletin No. S-351.
291 *Superior Elec. Co.

Regulators, Jet Pipe. . . . . The simplest accurate long-life solution to any regulator problem. For further information on type of regulator control which best fits your operation, refer to Bulletin No. 139.
426C Askania Regulator Co.

Regulators, Pressure. . . . . Offers positive, accurate pressure reduction in a range from 1 to 100 pounds. The Davis No. 13 is ideal for control of unit heaters, steam kettles, vulcanizers, presses, etc. Catalog 200.
L427 *Davis Regulator Co.

Regulators, Pressure, Self-Contained. . . . . Series 95 self-contained regulators are simple and sturdy and are suitable for steam, air, gas, oil, water and other fluids. For further information, see Bulletin C-95.
79 *Fisher Governor Co.

Regulators, Temperature. . . . . The Fulton Syiphon No. 999-T temperature regulator provides the accuracy and simplicity that mean lower processing and maintenance costs. Request Catalog D-NC.
63 *Fulton Syiphon Div.

Regulators, Unit. . . . . Entirely self-contained for automatic control of flow, pressure, proportioning and other variables. Versatile, accurate, dependable, designed to give long efficient service. Bulletin 155.
426D Askania Regulator Co.

Rotameters. . . . . New 12 p. bulletin contains photographs and cutaway drawings of complete line of Brooks Armored Rotameters. Also describes & illustrates available Rotameter Extensions. Bul. No. 130.
426E Brooks Rotameter Co.

Scanning & Logging Systems. . . . . Fully illustrated, 14 p. brochure describes the Taylor "Trans Scan Log" control system. Permits quick identification, evaluation & correction of any process change. Bulletin 98268.
310 *Taylor Instruments Cos.

Spectrometers, Mass. . . . . For fundamental petroleum and petrochemical research, for process development and for control, investigate the 21-103C. Complete and detailed information in Brochure No. CEC 1800C-X18.
69 *Consolidated Electrodynamics.

Spectrophotometers, Recording. . . . . 8 p. bulletin contains features, specifications, applications, operation and bibliography on the sensitive color measuring instrument. Request Bulletin GEC-307B.
426F General Elec. Co.

*From advertisement, this issue

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LITERATURE . . .

Transmitters.....The Tel-O-Set Transmitter is a device for measuring either temperature, gage pressure, or absolute pressure. Bulletin lists complete specifications. Request Specification 1003-1.
427A Minneapolis-Honeywell.

Transometers.....6 p. bulletin describes the applications for, and the features of, the Askania Transometer which comprises a positive displacement type flow meter & a pneumatic signal transmitter. Bul. 301.
427B Askania Regulator Co.

Pipe, Fittings, Valves

Fittings, Air Hose.....Le-Hi Air Hose Fittings for mining, tunneling, contracting, quarrying, construction & in industry wherever compressed air is utilized. Details are made available in Bulletin 110.
427C Hose Accessories Co.

Fittings, Pipe.....Presents newest catalogue of stainless steel pipe fittings which shows all standard pipe fittings and flanges, flanged fittings, butt weld fittings, etc. Request fully illustrated Catalog No. 653.
352 *Cameo Products.

Fittings, Stainless & Alloy Steel..... Engineering data & size dimensional information included in new 8 p. bulletin. Used for high temperature & corrosive applications in process industries. Bulletin S-1-55.
427D Watson-Stillman Fittings.

Fittings, Stainless Steel.....Speedline fittings simplify pipeline design. Details of the greater design flexibility possible with Speedline fittings . . . at lower cost . . . in new fully illustrated catalog.
TL429 *Horace T. Potts Co.

Fittings, Stainless Steel.....New stainless steel fittings will assure you of long, trouble-free service in tough piping applications . . . will reduce down-time and cut maintenance costs. Bulletin No. S-3-55.
427E Watson-Stillman Fittings.

Joints & Couplings.....Teflon expansion joints and flexible couplings absorb shock, vibration, thermal expansion and contraction. Connect unlike piping ends and nozzles. Covers complete data in Bulletin EJ-1155.
325 *U. S. Gasket Co.

Nozzles, Spray.....Reach a new peak in spraying efficiency . . . with Yarway non-clog nozzles. Reference includes capacities, dimensions, application information, etc. Request Spray Nozzle Book No. N-617.
253 *Yarnall-Waring Co.

Pipe & Fittings.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Catalog Section No. S-7000.
157c *National Carbon Co.

Pipe & Fittings, Glass.....Glass Pipe & fittings for full-scale production operations. Strengthened by end-tempering & feature corrosion-resistance, non-contamination, etc. Catalogs EA-1 & EA-3 offer full data.
42-3a *Corning Glass Wks.

Pipe & Fittings, Jacketed.....Hetherington & Berner, Inc., engineers-manufacturers, announces the availability upon request of a new literature reference describing their line of jacketed pipe and fittings. Bulletin J-56.
BL441b *Hetherington & Berner.

Pipe & Fittings, Plastic.....Two types of unplasticized polyvinyl chloride pipe & fittings are described in a new product bulletin. One type is a normal impact grade, and the other a high impact grade.
427 Carpenter Steel Co.

*From advertisement, this issue

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LITERATURE . . .

Pipe & Fittings, Stainless.....New bulletin deals with the use of seamless and welded stainless steel pipe & stainless welding fittings in the process industry. For further information, see Bulletin TB-410.
428A Babcock & Wilcox Co.

Pipe, Fittings & Valves, Plastic.....Vanton Pump offers three basic plastic lines to meet varied pipe, fitting & valve requirements. Non-contaminating properties . . . high mechanical performance. Bulletin PL-101.
296a *Cooper Alloy Corp.

Pipe Installation, Glass.....Pipe is easy to install & low in installed cost compared with other corrosion-resistant materials. Available in 6 standard sizes from 1- to 6-inch. I.D. inclusive. Installation Manual PE-3.
42-3b *Corning Glass Wks.

Pipe, Plastic.....Polyvinyl Chloride is the unparalleled material for plastic pipe. It's a high quality unplasticized-rigid pipe designed to do a better job than any other material. The full story in Bulletin 24.
162 *U. S. Steel Corp.

Pipe, Plastic.....Ace Rivivlor is a new rigid threaded plastic pipe with good aging & high impact strength. Not affected by most inorganic acids & alkalis. Excellent for many organics. Request Bulletin CE-56.
332 *American Hard Rubber Co.

Pipe, Saran Lined.....Saran lined pipe, fittings and valves cut corrosion costs . . . can be cut in the field with available pipe fitter's tools. Liquid never touches metal in saran lined pipe. Request details.
*Saran Lined Pipe Co.

Tubes, Condenser.....Trufin S/T condenser tube has approximately twice the heat transfer surface of plain tube—extracts more BTU's per foot of tube. Request new illustrated literature, "Process Flowsheet Catalog."
277 *Wolverine Tube Div.

Tubes, Condenser.....Arsenical Admiralty-439 and Ambraloy-927 condenser tubes for normal service, and Cupro Nickel, 10%-755 and Cupro Nickel, 30%-702 for severe stress-corrosion cracking. Pub. B-2.
294 *American Brass Co.

Tubes, Electronic.....Chatham electronic tubes for commercial, industrial and military applications. Bulletin discusses rectifiers, thyratrons, special purpose tubes, twin power triodes & hydrogen thyratrons.
428B Gera Corp.

Tubing, Instrument.....New 4 p. bulletin gives full information on advantages, limitations, installation, and available stock sizes and colors for all products in the Dekoron line. For details, see Bulletin 456.
428C Samuel Moore & Co.

Tubing, Stainless Steel.....In selecting tube materials you should bear in mind (1) the difference between initial cost & installed cost (2) the degree of corrosion & oxidation protection afforded. Bulletin TB365.
318 *Babcock & Wilcox Co.

Unions, Forged Steel.....Describes line of new forged steel unions. Presents complete dimensions of unions in sizes ¼" to 2" in 3000 lb. class. Also covers outstanding design features. Illustrated Bulletin U-1.
343 *Watson-Stillman Fittings.

Valves.....There's an Ace hard rubber, rubber-lined, or plastic-lined valve for every corrosion application. Sizes from 2" to 24". Diaphragm, gate and check types. Lists chemicals handled in Bulletin CE-52.
333a *American Hard Rubber Co.

Valves.....New catalog describes company's line of electrically operated two-way solenoid valves for air, gas, steam and liquid flow control. Lists dimensions, specifications & applications. Catalog 200.
428D Atkomatic Valve Co.

*From advertisement, this issue

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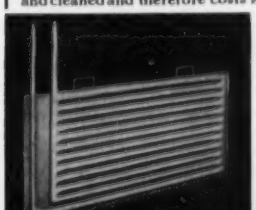

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LITERATURE . . .

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371-2 *Crane Co.

Valves.....Valves specifically designed for the tougher, more difficult problems in automatic and manual valve operation. Catalog covers: design & operating features; performance; engineering data.
429A P-K Industries.

Valves.....6 p. bulletin on Safety Clean-out Valve for use on buried tank installations for storage of volatile, inflammable liquids. Describes construction & operation features. Request your copy.
429B Petrometer Corp.

Valves, Air.....The Controlled Closing Air Valve, Type CCAV, a new concept for the protection of pipe lines against the damaging effects of surge & built-up pressures, is illustrated in Bul. 200.
429C Simplex Valve & Meter Co.

Valves, Butterfly.....In this new Catalog you get the complete dimensions, layout drawings, specifications and materials for all pressure ratings of R-S Butterfly Valves that are now standardized. Catalog 160.
364 *S. Morgan Smith Co.

Valves, Check.....When used with tanks, dry cans, retorts & pressure vessels of all kinds, the Durabla check valve unit is the lowest cost, high-quality valve you can purchase. Details in Bulletin CE-76.
330 *Durabla Mfg. Co.

Valves, Check.....Norwalk disc type check valve flanged and fabricated in steel . . . for gas and air . . . low and high pressures. Will operate at full capacity with negligible differential. Buls. 1000M & 1300M.
429D Norwalk Valve Co.

Valves, Control.....Both the diaphragm-actuated Type CV-D & the piston-actuated Type CV-P valves will handle water, steam, air, gas, oil or other similar fluids at unlimited pressures. Bulletin 1027.
429E Blaw-Knox Co.

Valves, Drop Forged Steel.....GP valves are setting new standards of performance in petroleum refineries, chemical plants, power plants, and related industries. Supplement No. 1 (Catalog F-9).
172 *Henry Vogt Mach. Co.

Valves, Fittings & Piping.....Catalog discusses Parks-Cramer jacketed piping layout, tubing jumpovers, materials, fittings, plug valves, relief valves, jacketed pipe, etc. Request Catalog No. 356.
429F Parks-Cramer Co.

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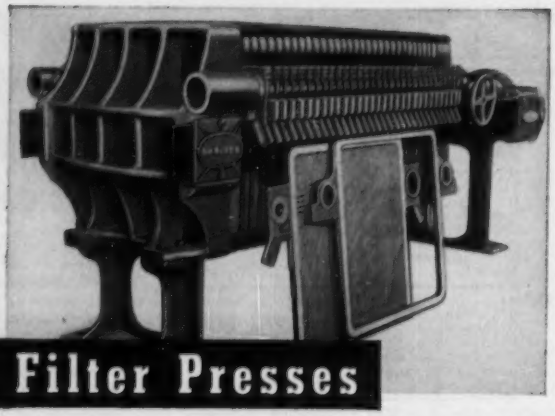

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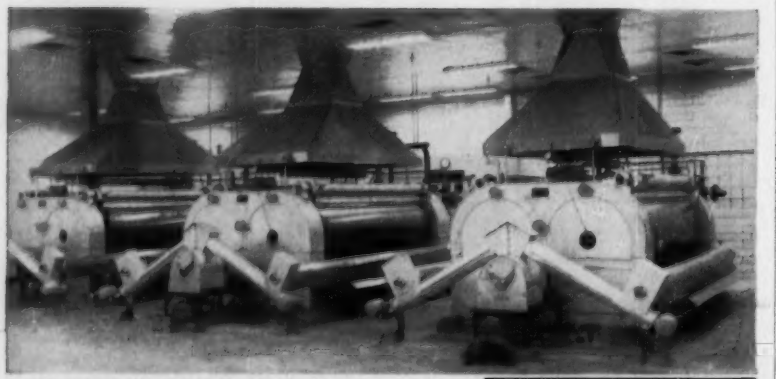

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LITERATURE . . .

Valves, Forged Steel.....The OIC 1221 gate valve and the 1621 globe valve are recommended for steam service up to 800°F . . . oil service up to 1000°F. Also for hydraulic service up to 2000 lbs. Form 195.
259 *Ohio Injector Co.

Valves, Gate.....Offers data on sturdy, small forged steel gate valves. Superhardened gate and seats assure tight closure, smooth operation and low maintenance. Complete information offered in Catalog No. 10.
156 *Chapman Valve Mfg. Co.

Valves, Gate.....For pressures up to 150 lbs. & temperatures to 180° use iron body gate valves with permanently bonded hard rubber lining. In rising stem, cylinder or motor operated, or quick-opening types.
358 *Darling Valve & Mfg. Co.

Valves, Gate.....Greenwood Gate Valve Line Blinds offer these features: no lifting of wedge; no spreading of line—just turn hand wheel; the simplest line blind on the market. See Bulletin No. GV-17.
430A Vernon Tool Co.

Valves, Globe & Angle.....Jenkins bronze globe and angle valves with teflon disc and packing can improve efficiency and economy in your hookups for critical service. For further information, see Bulletin 116.
159 *Jenkins Bros.

Valves, Needle.....New pressure gage needle valve features a one-piece alloy steel body, a welded bonnet for maximum safety, and a multi-compound, non-crushable V-type packing. Request full details.
430B Oil Center Tool Co.

Valves, Reducing.....A simple air loaded, diaphragm operated, pressure reducing valve that is virtually maintenance-free for steam heat or process steam aplication. Details in Bulletin No. 561.
308 .*Leslie Co.

Valves, Reducing, Pressure.....Recommended for critical control applications requiring unusually sensitive and accurate regulation . . . and extreme pressure reductions. For details, see Bulletin J-1160.
76b *Jordan Corp.

Valves, Relief.....Norwalk relief valves for relieving gas or liquid under pressure or vacuum & for maintaining constant pressure or vacuum on lines, holders & tanks. For complete details, see Bulletin 6500.
430C Norwalk Valve Co.

Valves, Safety Relief.....Features: economical "2 in 1" design, peak performance, absolute protection, & maximum interchangeability. Full range of sizes & pressures available. Request Catalog No. 1900.
96 *Manning, Maxwell & Moore.

Valves, Slide.....Data Sheet describes complete line of Universal Slide Valves, designed especially for use in pipeline transporting solid materials in liquids. Available on request, Data Sheet Ub.
430D Allen-Sherman-Hoff Co.

Valves, Spray.....To minimize build-up of PVC resins or similar products in a glassed steel vessel, Pfaudler offers a new glassed spray valve. For more complete information, request Bulletin 886.
24-5b *Pfaudler Co.

*From advertisement, this issue

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LITERATURE . . .

Process Equipment

Absorbers.....For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22° Baume acid. Pneumatic automatic control. Complete information in Catalog Section No. S-7460.
157g *National Carbon Co.

Agitating Equipment.....Use Nettco Flomix to combine liquids & solids as they flow through a pipe line. For complete information, company makes available bulletins & data. Nos. 531, 551 & 532.
155 *New England Tank & Tower.

Blenders.....Designed for fast, efficient operation, Day Blenders can be equipped with a variety of agitators for your specific product. For further details on these blenders, request Bulletin No. 800.
322 *J. H. Day Co.

Blenders.....Three new, exclusive features in spiral & heavy duty blenders are described in new catalog. They are: solid end construction; removable shaft; completely sanitary. Request catalog.
431A American Welded Tank.

Blenders, Dry.....Sturtevant Dry-Batch Blenders speed up production with 4-way mixing & shorten shut-downs with "open-door" design. Batches from 500 to 40,000 lbs. exactly as you want them. Request Bulletin.
89 *Sturtevant Mill Co.

Blenders, Twin Shell.....In plant after plant . . . The Patterson-Kelley twin shell blender does the job better, faster, and lasts longer. For complete information on product line request descriptive Catalog 13.
241 *Patterson-Kelley Co.

Centrifugals.....When your process calls for liquid-solids separation by centrifugal force . . . you can do it more economically with the new Tolhurst Center-Slung centrifugal. Request Bulletin TC-14-55.
359 *Tolhurst Centrifugals Div.

Centrifuges.....Titan Superjector Centrifuge for continuous removal of solids from 1 or 2 liquids and for continuous concentration of solids by removal of liquid from slurries. For details, see Bulletin 930.
24-5e *Pfaudler Co.

Cleaners, Air.....Company offers an improved self-charging, electrostatic air cleaner for heating, ventilating and air conditioning systems. Detailed information appears in "Heavy Duty Pliotron" folder S-5161.
431B Goodyear Tire & Rubber Co.

Crushers, Gyratory.....''One-man, one-minute'' product control, a feature of Allis-Chalmers primary, secondary & tertiary gyratory crushers, cuts setting changing time from hours to seconds. Request literature.
35-40b *Allis-Chalmers Mfg. Co.

Dehydrators, Vacuum.....Because of its flexibility, the continuous Chain Belt Vacuum Dehydrator can be adapted to the drying of many products such as chemicals & pharmaceuticals. Buls. Nos. 55-126 & 55-127.
431C Chain Belt Co.

Demineralizers.....Builds complete water treating plants, maintaining a large, diversified engineering staff to make thorough process analyses and design exactly the equipment needed. Bulletin 200 on request.
403 *Industrial Filter & Pump.

Demineralizers.....Builds complete water treating plants, maintaining a large, diversified engineering staff to make thorough process analyses and design exactly the equipment needed. Bulletin 200 on request.
431D Penfield Mfg. Co.

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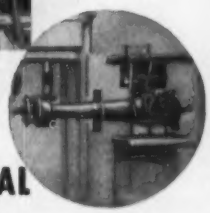
VERTICAL



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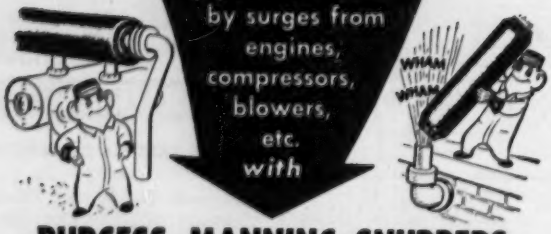

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LITERATURE . . .

Disintegrators.....RI Series Disintegrators are available in stainless or carbon steel as standard items, or in other necessary metals on special order. A new Rietz Bulletin, No. R-507, is available on request.
432A Rietz Mfg. Co.

Distillation Apparatus.....Build your Unitized Distillation Assembly out of standard, precision-made, interchangeable units ordered directly from stock. For further information, request Bulletin FS-256.
432B Fisher Scientific Co.

Distillation Processing Units.....The Rota-Film Still, a new distillation processing unit, features a sanitary, self-cleaning packaged unit capable of handling a large capacity on a continuous basis. 16 p. booklet.
432C Arthur F. Smith Co.

Dryer-Blenders.....The conical, rotating dryer-blenders give you speed, ease & efficiency for drying & blending a broad range of corrosive & heat-sensitive materials, using either steam or hot water. Request details.
48-9g *Glascote Products.

Dryer-Blenders.....Solid one-piece construction of inner vessel for maximum strength . . . no joints or clamps to break up the drying surface area . . . effective drying with no waste of steam or hot water. Data Sheet 26.
24-5d *Pfaudler Co.

Dryers.....Help solve problems of drying air or other gases. Offer valuable advantages: simplicity of operation & maintenance; low installation cost & minimum maintenance expense. Details in Bulletin D-27.
71 *C. M. Kemp Mfg. Co.

Dryers, Spray.....Special Nerco-Niro designs can be supplied for abrasion-resistance and corrosion resistance, for coagulating materials, for fine or coarse particles, high or low bulk density. Bulletins 226 & 230.
411 *Nichols Engrg. & Rsch. Corp.

Dust Collectors.....Lowest priced wet dust collector in its class (units of 1500 to 50,000 cfm capacity designed for high efficiency dust collection, including extreme fines). Request Bulletin No. 274.
280 *American Air Filter Co.

Dust Collectors.....New self-cleaning collector offers continuous automatic operation, constant air volume and suction, uniform air flow resistance at low cost. Request Bulletin No. 915.
323 *Pangborn Corp.

Dust Control.....Sly flat bag dust filters get all the dust. Pioneers and leaders in industrial dust control, they have a complete range of equipment for all process operations. Request Dynaclone Booklet.
426 *W. W. Sly Mfg.

Evaporators.....Complete Swenson Catalogue contains full information on long-tube vertical evaporator, spray dryers, crystallizers, forced circulation evaporators & recovery equipment for pulp mills.
65a *Swenson Evaporator Co.

Evaporators, Turba-Film.....Evaporators give rapid one-pass evaporation of liquids, slurries and gases . . . especially heat-sensitive substances . . . all by continuous process. Literature available on request.
261 *Rodney Hunt Mach. Co.

Filter Fabrics.....The right fabric adds efficiency to continuous operation. Announces availability of a fully illustrated booklet, "Filter Fabric Facts," describing filter fabric development and application.
312 *Wellington Sears.

Filter Leaves.....New "RIM-LOK" Filter Leaf provides simple closure of metal filter cloth in leaf frame without use of rivets, bolts or solder. Made of any commercial alloy. RIM-LOK Bulletin on request.
B456 *Multi-Metal Wire Cloth Co.

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LITERATURE . . .

Filter Paper.....The use of E&D filter paper as a cover may be indicated if your filter medium is blinding or clogging. Will recommend proper grade for use and send samples for testing. "Filtration Analysis Report."
B428 *Eaton-Dikeman Co.

Filters.....Dollinger Corp. offers a new series of bulletins called "Filter Facts." Filters for every industrial & ventilating need—liquid, pipe line, low & high pressure, etc. Request Vol. 1, No. 1.
433A Dollinger Corp.

Filters.....All types of continuous rotary vacuum filters . . . string horizontal, scraper, precoat, etc. . . . are custom designed & manufactured by FEInc. Company makes Bulletins available on request.
165 *Filtration Engrs.

Filters.....Cuno's new Super Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates & eliminates the need for replacement cartridges. Request Catalog SAK-057.
378 *Cuno Engrg. Co.

Filters.....Informative data on construction, installation, testing and performance of the M-S-A Ultra-Aire Space Filter with its new filter media is contained in new 4 p. Bulletin No. 1505-3.
433B Mine Safety Appliances Co.

Filters, Horizontal Rotary Vacuum..... Versatile, fast acting filter has NU drive. Offers high capacity, fast dewatering and excellent cake wash. For further information on compact filter, request Bul. 400.
12 *Cleveland Worm & Gear Co.

Filters, Pipe Line.....Staynew pipe line filters for clean dry air in air operated instruments, air operated tools, pneumatic controls, industrial processes. For further details, see Bulletin 200.
56 *Dollinger Corp.

Filtration, Celite.....Removes colloids and other suspended impurities; requires no coagulants; removes microscopic solids; plant occupies small area. For further details, request Bulletin No. FA-51A.
433C Johns-Manville Corp.

Filtration Equipment.....Sperry makes available a catalog complete with charts, tables, & diagrams to help in the operation, maintenance & selection of filtration equipment. Request your copy. Catalog 7-E.
350 *D. R. Sperry & Co.

Generators, Inert Gas.....At a moment's notice of fire or explosion dangers, smothering gas flows instantly from R-C inert gas generators. Details on how they afford constant protection in Bulletin IGG-155.
370f *Roots-Connersville.

Homogenizers, Industrial.....Profusely illustrated folder describes the Gaulin Homogenizer. Includes: construction and operation; theory of homogenization; products processed; specifications; etc. Bulletin H-55.
102 *Manton-Gaulin Mfg.

Hoods, Exhaust.....New bulletin describes different designs of exhaust hoods for dust control in the woodworking industry. Gives localized applications in this specialized field. Bulletin 270-E3.
433D American Air Filter Co.

*From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

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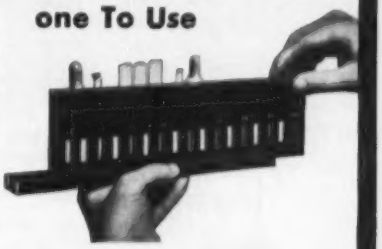
give QUICK, ACCURATE pH, CHLORINE TESTS

Complete, Compact Kit—Easy for Anyone To Use



Exact determinations of pH or chlorine content can be made in a matter of minutes with Taylor Comparators. Easy-to-use Taylor Comparators require no additional equipment or chemicals. Everything necessary to make tests comes with each comparator. Compact carrying case also available. No experience or technical knowledge needed. To test, simply fill the three tubes with the sample, add reagent to center tube, move color standard slide across until colors match and read value direct from slide.

All Taylor Comparators are durable, lightweight and portable; many serve for several determinations with only a change of color standard slides.

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All Taylor liquid color standards carry an unlimited guarantee against fading. There's never any danger of mechanical inaccuracy. Each complete set of standards is mounted in a lightweight, durable, plastic slide. There are no fragile single standards to handle.

CALL YOUR LABORATORY SUPPLY HOUSE for Taylor sets, or write direct for FREE HANDBOOK, "Modern pH and Chlorine Control". Gives theory and application of pH control . . . illustrates and describes full Taylor line.

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APCO Z4
Process **PUMPS**

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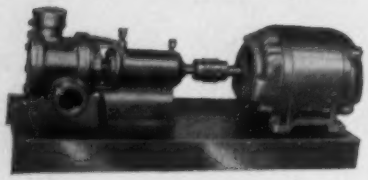

Modern industry offers a challenge in the form of new and difficult applications which demand improved pumping techniques. In the Type Z4 APCO Turbine-Type Pumps will be found the complete answer to many of the applications involving liquefied gases and other light, non-viscous liquids. Obtainable in special metals with notable economy.

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Stop accidents — speed maintenance with these rugged, economical, easily-attached valve and flange covers that protect personnel and equipment by directing harmful chemical pipeline leaks to the ground.

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HIGH-TEMPERATURE Teflon "SPRAY-STOPS" (Non-Indicating) for application under continuous working conditions up to a temperature of 500° F.

STANDARD NON-INDICATING "SPRAY-STOP" Valve and Flange Covers also available.

SPECIAL COVERS MANUFACTURED TO CUSTOMER'S SPECIFICATIONS. CE

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LITERATURE . . .

Kilns, Rotary.....Offers these improvements: all welded; one-plate-to-a-circle construction; patented heat recuperation; effective air seals; centralized control; air-cooled feed and discharge ends. Details.
35-40g *Allis-Chalmers Mfg. Co.

Kilns, Rotary.....Efficient thermo-processing of products. Used in the production of lime, bauxite, cement, sodium silicate, alumina, etc. Complete data on design features offered in illustrated Bulletin 1115.
16 *Traylor Engrg. & Mfg. Co.

Mills, Blade.....Designed for large tonnages of hard-to-wash materials, blade mills effectively disintegrate & wash into suspension tenacious clays and other unwanted substances. Request literature.
35-40e *Allis-Chalmers Mfg. Co.

Mills, Compacting.....Used to produce paper-thin flakes or to increase the apparent density of your product. Mills handle a variety of grinding, crushing, rolling or compacting jobs. Details available.
35-40j *Allis-Chalmers Mfg. Co.

Mills, Disc Roll.....Particularly suited for grinding relatively soft minerals, such as limestone, coal, bauxite, talc, etc. Describes details of operation and application of mill in thoroughly illustrated 8 p. Bulletin No. 52.
416 *Hardinge Co.

Mills, Grinding.....Allis-Chalmers can meet your specifications whether your process calls for individual mills or a grouped stage grinding series. Request details on 7 different types of grinding mills.
35-40c *Allis-Chalmers Mfg. Co.

Mills, Roller.....When making any kind of powdered pigments or commercial fillers, use of High-Side Roller Mill with Whizzer Separation offers important production advantages. See Catalog No. 79.
320 *Raymond Div.

Mixers.....Triple action mixing assures uniformity, versatility, dependability & low cost. Blending, folding & mixing created by the unique triple ribbon and spiral assembly. See Bulletin TSB 6-538.
434A Strong-Scott Mfg. Co.

Mixers.....Powered by a 50 hp. silent chain drive motor, the No. 15 is constructed of stainless steel, & jacketed to carry 125 psi pressure of steam or water. Working capacity is 100 gals. Request Catalog.
163 *Baker Perkins.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
127a *Mixing Equipment Co.

Mixers.....The Velofin Mixer has a multiple disk impeller. It is effective in any viscosity; can be started when embedded in solids; reduces mixing time; requires no speed reduction. Offers detailed Bulletin.
B347 *H. E. Serner Co.

Mixers, Horizontal Batch.....Style "B" mixer loads, blends & discharges rapidly—is clean, dustless, sanitary. Handles all types of dry, damp & free-flowing wet materials. Request Bulletin No. 95.
85a *Sprout-Waldron.

Mixers, Portable.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. No. B-108.
127d *Mixing Equipment Co.

Mixers, Portable.....Illustrated folder describes the all-new Porta-Blend. A portable liquid and dry mix blender, with self-contained power and feeder units. Request your copy of Bulletin NPB6-613.
434B Strong-Scott Mfg. Co.

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FAST SERVICE

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Drum & Container

LINERS • BAGS
SPECIAL PROTECTORS

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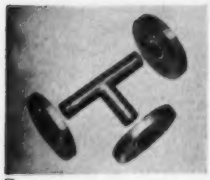

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STAINLESS STEEL FITTINGS

manufactured by HORACE T. POTTS COMPANY
500 East Erie Avenue • Philadelphia 34, Pa.

LITERATURE . . .

Mixers, Side Entering.....Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc., in completely illustrated Catalog B-104.
127e *Mixing Equipment Co.

Mixers, Top Entering.....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog No. B-102.
127f *Mixing Equipment Co.

Mixers, Top Entering.....Makes available pertinent information on top-entering mixers (propeller type) . . . for closed tanks, pressure & vacuum . . . for open & loose-covered tanks. Data in Catalog No. B-103.
127g *Mixing Equipment Co.

Mixers, Vertical.....Permit the mixing of a limited amount of liquids with dry ingredients. Occupy little floor space & have low hp. requirements. Can be adapted to meet your special needs. Request Bulletin 95.
85b *Sprout-Waldron.

Presses, Filter.....Offer numerous features: lowest cost per sq. ft. of filtering area; produce perfect clarity of filtrate; can be used in decolorizing—deodorizing; etc. Request illustrated Catalog No. 55.
430a *T. Shriver & Co.

Process Equipment.....32 p. bulletin covers all Allis-Chalmers equipment for the process industries. This bulletin, as well as literature covering specific equipment lines, is available. Bul. 25C6177.
35-40a *Allis-Chalmers Mfg. Co.

Process Equipment.....Bowser "Digest" covers: meters with ticket printers providing accounting records of liquid receipts, transfers and deliveries; filters of all types; blenders for any number of liquid components.
B430 *Bowser, Inc.

Reactors, Glassed Steel.....Offer a wide range of sizes . . . 5 to 4,000 gals.; several ways to adapt top-head openings, agitators, seals, and valves in meeting changing temperature & pressure requirement. Bul. 936.
4th Cover *Pfaudler Co.

Screens, Gyratory.....All-metal unit is designed to separate dry granular materials into two, three and four predetermined sizes. Request further information on Allis-Chalmers gyratory screens.
35-40i *Allis-Chalmers Mfg. Co.

Screens, Vibrating.....Allis-Chalmers vibrating screens are built in single and multiple-deck models for use in scalping, wet or dry sizing, washing, rinsing, dewatering, and media recovery. Details on request.
35-40d *Allis-Chalmers Mfg. Co.

Scrubbers, Gas.....Installations of this equipment successfully handle difficult gas scrubbing problems. Help stop air pollution and recover valuable materials. World-wide usage. Bulletins M-102 & M-103.
143 *Chemical Construction Corp.

Separators, Laboratory.....Company manufactures new laboratory machines which aid chemical process research and development. Complete technical information on these laboratory separators available upon request.
365 *Superior Separator Co.

Stirrers.....The Slo-Speed Stirrer was developed for use in laboratory procedures requiring stirring at a slow, constant speed. Bulletin discusses uses, construction & features. See Bulletin 738.
435A Precision Scientific Co.

Vessels, High Pressure.....Cole can build you the kind of high-pressure tanks or vessels you require . . . any size, any shape, any metal. For complete product information, request copy of catalog, "Tank Talks."
T443 *R. D. Cole Mfg. Co.

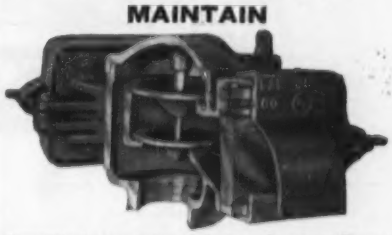
*From advertisement, this issue

PROTECTOSEAL
vapor conservation vents

DESIGNED FOR . . .

LOW-COST MAINTENANCE

FULLY FIRE PROTECTIVE
SIMPLE and EASY to MAINTAIN



Simplified, one-piece design locates flame arrester outside pressure-tight housing where it is easily accessible.

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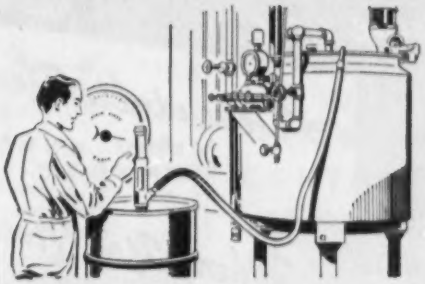

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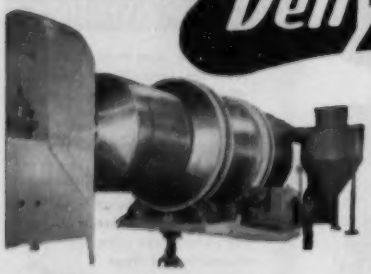

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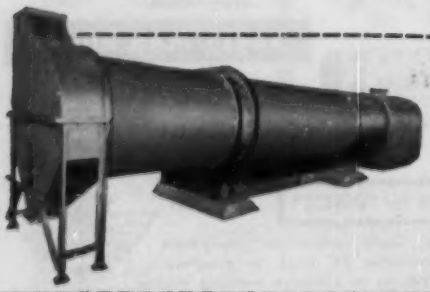

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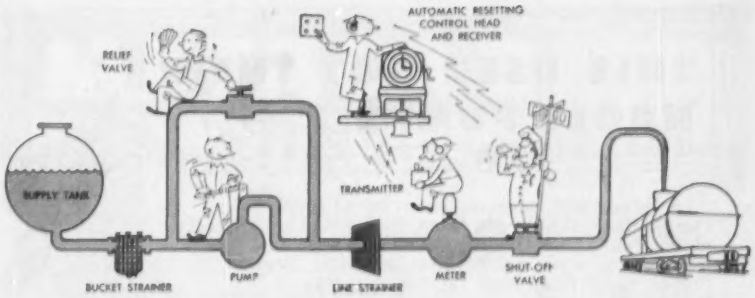

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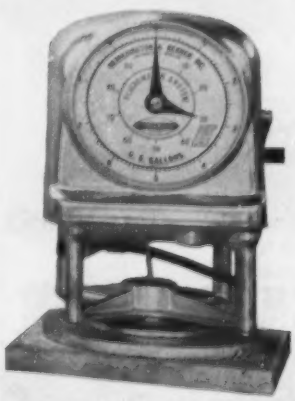

This animated picture illustrates a typical remote control Fluidometer application. Remote control of this general type is recommended when plant conditions or arrangement make direct control impractical or impossible. With a system of this type the Fluidometer control head can be located away from the meter. Shown at the left is the automatic resetting control head, which controls the operation of the shut-off valve to give completely automatic batching. Available either jacketed or unjacketed—"tailor made" to fit your needs. New Bulletin Fl-56 will be sent on request. For information on jacketed pipe and fittings write for Bulletin J-56.

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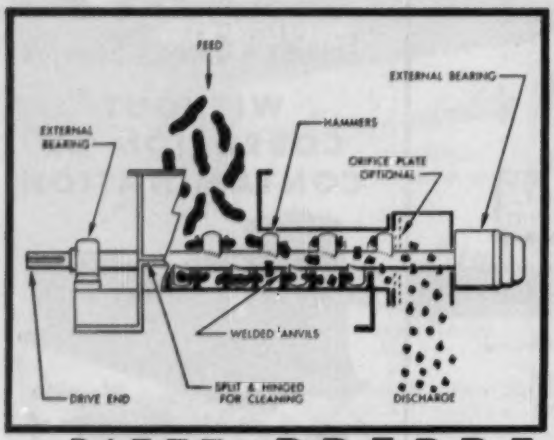

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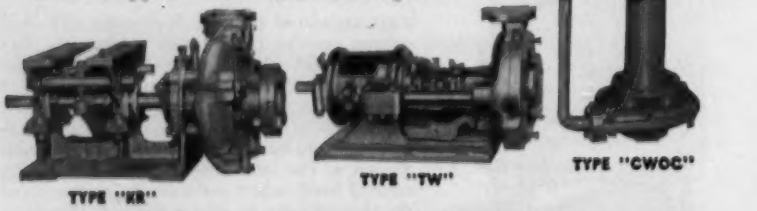

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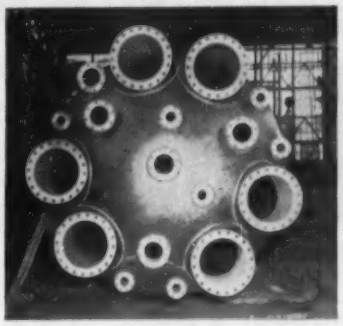

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17b	58	87	125	187c	241	265	297	338	378	411K	417G	R423	429A	437B	
17c	59a	88	127a	187d	242A	267	298	339	379	411L	418	423A	429B	437C	
18	59b	89	127b	187e	242B	269	299	340	380	412	418A	423B	429C	437D	
19	60	90a	127c	187f	242C	270	300	341	381	412A	418B	423C	429D	437E	
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34b	68c	92d	141	197	246E	281a	309d	352	383k	413C	419C	425B	431A	437P	
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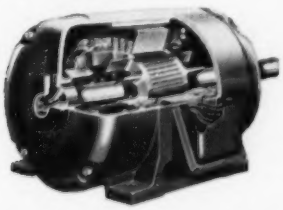

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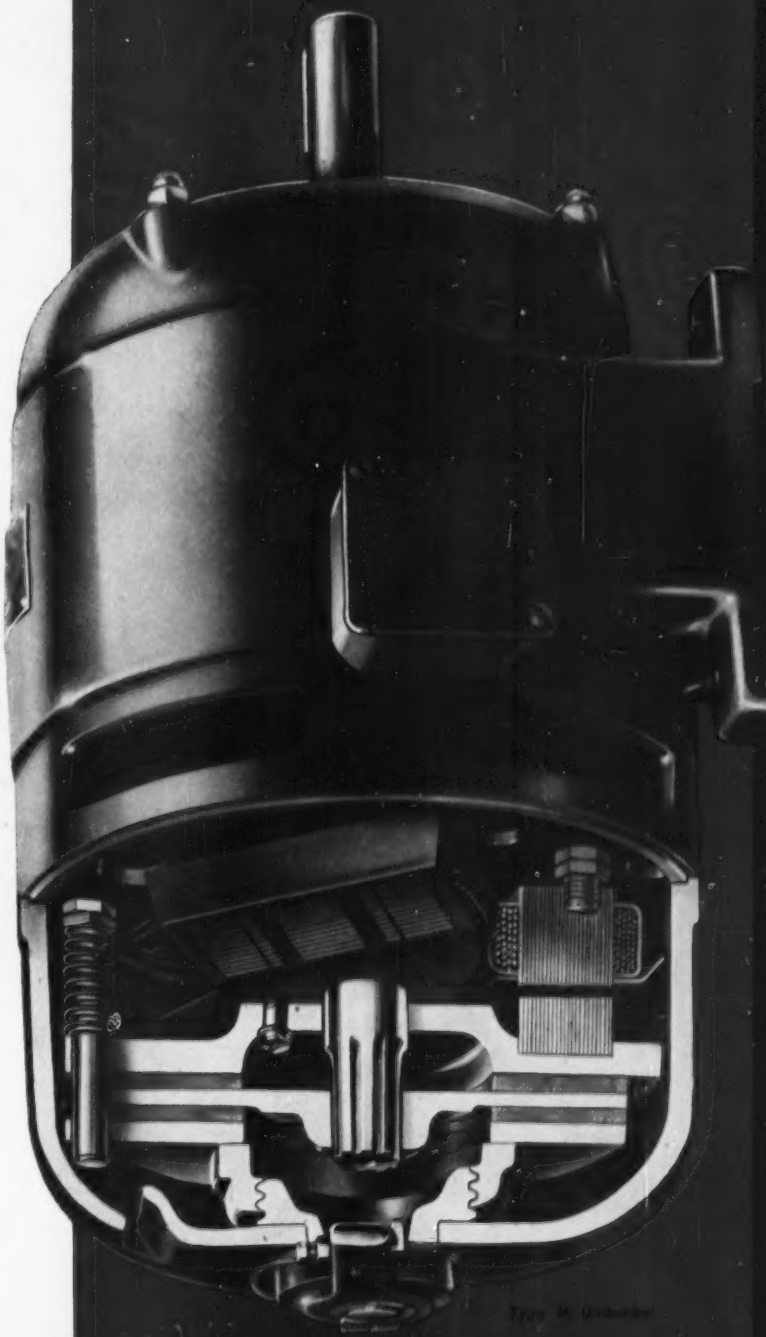

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